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National Transit Summaries and Trends

For the 1990 Section 15 Report Year

Audit Review and Analysis Division
Office of Capital and Formula Assistance

National Transit Summaries and Trends

For the 1990 Section 15 Report Year

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Executive Summary

National Transit Summaries and Trends is a new publication that provides an overview of the national public transit industry. It highlights the aggregate financial and operational characteristics and trend information of public transit from 1987 to 1990. Key statistics and performance indicators are presented by transit modes, by bus system size, by urbanized area, and by geographical regions. This information should give the reader a better understanding of the changes in public transit. *National Transit Summaries and Trends* is a prototype publication, and comments are welcome.

Five key concepts address fundamental questions about transit service. These questions are:

- How much service is used? Chapter 2, Service Consumption, provides the answers.
- How much service is supplied? Chapter 3, Service Supplied, reports this information.
- How much does the service cost? Chapter 4, Operating Expenses, summarizes the data.
- How is the service paid for? Chapter 5, Operating and Capital Funding, presents this information.
- How safe and reliable is the service? Chapter 6, Safety, Reliability, and Maintenance, reports this data.

Based on the analysis and the report findings, the following significant trends have been identified for the period 1987 through 1990:

Service Consumed

The demand for transit service as measured by the number of trips and the amount of passenger miles has remained stable since 1987. Ridership between modes varied substantially; Bus, Heavy Rail and Commuter Rail accounted for almost 95 percent of all riders. Four of the primary transit modes showed growth during the period, with the largest percentage of growth occurring in the Demand Response mode. The highest levels of ridership occurred in the largest urbanized areas and in the Northeast region, which are characterized by high population densities and an extensive network of rail transportation systems.

Service Supplied

The amount of service provided has continued to increase steadily, and, as measured by revenue miles, is seven percent higher in 1990 than 1987. Bus supplied 61 percent and Heavy Rail supplied 21 percent of vehicle miles. Bus and Heavy Rail also supplied 71 percent and 15 percent of vehicle revenue hours, respectively. The largest urbanized areas accounted for 81 percent of the service supplied, and the Northeast region (which includes the New York Metropolitan area and Boston) provided 35 percent of vehicle revenue miles.

Operating Expenses

From 1987 to 1990, operating expenses increased 19 percent for an average of approximately six percent per year. Operating expense per vehicle mile increased less than 12 percent, or less than four percent per year. The Consumer Price Index increased almost 16 percent over the same period. Consequently, operating expense adjusted for service changes increased by less than the rate of inflation from 1987 to 1990.

Salaries, wages, and benefits comprised over 70 percent of the cost of service. Spending on purchased transportation continued to increase during this period, giving transit systems a cost-effective means to provide increased service. By 1990, six percent of total operating expense was for purchased transportation. Bus mode absorbed approximately 53 percent of total operating expenses, while Heavy Rail and Commuter Rail required 26 percent and 15 percent respectively. Transit systems operating in the largest urbanized areas expended almost 90 percent of total operating expense. The Northeast region alone represented over 46 percent of total operating expenses.

Sources of Operating Funds

A combination of sources paid for the cost of transit service. Passenger fares covered 37 percent of the total operating expenses while State and local governmental assistance (including assistance specifically dedicated to transit) provided 58 percent. The Federal government contributed five percent.

The proportion of operating funding paid through passenger fares remained very stable over the four year period of analysis, ranging from 36 percent to 37 percent each year. Passenger fare revenue increased 13 percent from 1987 to 1990. State, local and dedicated assistance increased almost 17 percent. Federal operating assistance declined nine percent.

Sources of Capital Funds Expended

The nation provided over $4.5 billion in capital assistance, in addition to operating assistance, during 1990. The Federal government provided over 58 percent of these funds. Total funding for capital assistance increased by 28 percent since 1987; Federal funding, by 11 percent; State and local funding, by 64 percent. One result of this investment was a marked decrease in the average age of the nation's fleet of vehicles.

National Transit Profile Summary

The National Transit Profile Summary provides an overview of the transit industry for 1990. The data was reported by 518 transit agencies in accordance with the Section 15 Reporting System administered by the Federal Transit Administration.

Exhibit 1
National Transit Profile Summary

General Information (System Wide)

Service Consumption (millions)	
Annual Unlinked Trips	7,965.6
Annual Passenger Miles	37,990.8
Average Weekday Unlinked Trips	26.9
Average Saturday Unlinked Trips	13.6
Average Sunday Unlinked Trips	8.1

Service Supplied	
Annual Vehicle Revenue Miles (millions)	2,466.8
Annual Vehicle Revenue Hours (millions)	168.9
Total Fleet	81,706
Vehicles Operated in Maximum Service	65,142
Base Period Requirement	28,338

Vehicles Operated in Maximum Service by Type of Service and Number of Systems Reporting by Mode *

	Directly Operated		Purchased Trans.	
	Vehicles	Systems	Vehicles	Systems
Bus	40,840	362	2,029	79
Heavy Rail	8,347	12	0	0
Commuter Rail	3,922	10	241	8
Light Rail	1,144	14	4	1
Demand Response	2,627	152	5,276	189
Other	630	24	82	8

* The total number of systems reporting is 518, of which 282 report two or more modes.

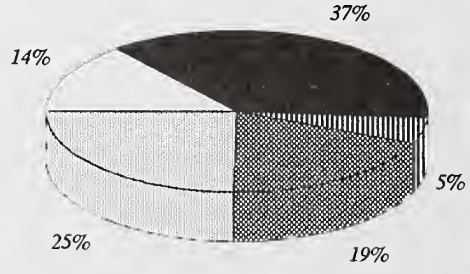
Financial Information (System Wide)

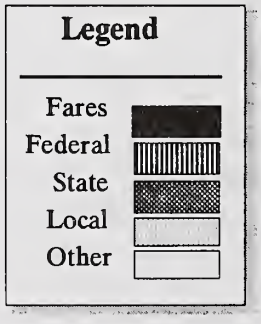
Sources of Operating Funds (millions)		
Passenger Fares		$5,592.7
Local Assistance		3,764.2
State Assistance		2,858.9
Federal Assistance		822.0
Other Revenues		2,198.9
Total Operating Funds	**(1990)**	**$15,236.7**

Summary of Operating Expenses (millions)		
Salaries/Wages/Benefits		$10,575.9
Materials & Supplies		1,472.1
Purchased Transportation		884.9
Other Expenses		1,781.7
Total Operating Expenses	**(1990)**	**$14,714.6**

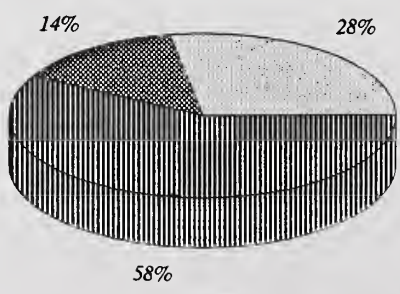
Sources of Capital Funds Expended (millions)		
Local Assistance		$1,254.2
State Assistance		644.6
FTA Sec. 3 Discretionary	853.2	
FTA Sec. 9 Formula	1,284.0	
FTA Other Assistance	428.0	
Other Federal Assistance	71.5	
Federal Assistance Total		2,636.7
Total Capital Funds Expended	**(1990)**	**$4,535.5**

Sources of Operating Funds





Sources of Capital Funds Expended



Introduction

Purpose of this Publication

National Transit Summaries and Trends is a new publication that provides an overview of the national public transit industry. It highlights aggregate financial and operational characteristics and trend information for key statistics and performance indicators. In prior report years, these data were found in Chapter 2, Aggregate Transit Statistics, of the *National Urban Mass Transportation Statistics Section 15 Annual Report.*

The data represent a portion of the 1990 Section 15 Annual Report. This report is intended to provide a national perspective of the American Transit Industry through graphics and tabular displays of relevant statistics. The statistics presented here permit an understanding of the performance and condition of mass transportation in the United States. This report is intended to serve as a reference for policy makers at all levels of government, transit professionals, and researchers at various institutions. The report provides a picture of the public transit industry in 1990 and its performance covering the Section 15 report years, 1987 through 1990.

This document is one of the three publications prepared by the Federal Transit Administration (FTA) that comprise the National Urban Mass Transportation Statistics, 1990 Section 15 Annual Report. The other publications are: 1) *Data Tables for the 1990 Section 15 Report Year*, which offers individual transit agency statistics in tabular formats; and 2) Transit Profiles Reports, in three separate documents (*Agencies in Urbanized Areas with a Population of Less Than 200,000*; *Agencies in Urbanized Areas Exceeding 200,000 Population*; and *The Thirty Largest Agencies*), which provide a graphic and numerical profile or summary of the financial and operating characteristics for each transit agency. The statistics for all three reports derive from a common database developed for the Federal Transit Administration's Section 15 Program for fiscal years ending between January 1 and December 31, 1990.

Comments Welcomed

National Transit Summaries and Trends was developed from the Section 15 Database. This document is a prototype for future reports of this nature. Comments regarding this document are encouraged and welcomed. Suggestions for additional or substitute topics and measures are solicited. The 1991 report year edition of the *National Transit Summaries and Trends* is scheduled to be published by the end of calendar year 1992.

Approach for Analysis

National Transit Summaries and Trends (NTST) addresses five basic questions about transit from a national perspective:

- How much service is used?
- How much service is supplied?
- How much does the service cost?
- How is the service paid for?

- How safe and reliable is the service?

National Transit Summaries and Trends takes on one particular facet of transit in each chapter and examines it from the multiple perspectives of Mode, Size of Bus Fleet, Size of Urbanized Area, and Region.

Modes

Modes are the first topic to be examined. (Since revenue is not universally reported by mode, Chapter 5, Operating and Capital Funding, does not include general information by mode.) The modes considered are Bus, Heavy Rail (also known as Rapid Rail), Commuter Rail, Light Rail, and Demand Response. All other modes have been grouped into the category of Other. This category includes such diverse modes as tramways, inclined planes, ferryboats, and vanpools. Combined, Other represents less than one percent of unlinked passenger trips, passenger miles, vehicle miles, and vehicle hours, and less than two percent of operating expense. Performance measures have not been evaluated for Other since the modes represented are so dissimilar.

Size of Bus Fleet

Bus service is the largest mode in terms of number of systems represented (53 percent), passengers (62 percent), and passenger miles (48 percent) consumed, and other criteria such as miles and hours of service supplied (examined in Chapter 3, Service Supplied). Therefore, the Bus mode has been reviewed in greater detail, based on system size. Bus systems have been grouped based on the number of vehicles required in maximum service. The categories are: fewer than 25 buses, 25 to 99 buses, 100 to 249 buses, and 250 buses and over. The comparisons of bus systems do not correlate exactly to the groupings by size of urbanized area, since some small systems provide service within large UZAs. However, there are parallels. (Refer to Assumptions for an example and more detail.) The groupings also provide a perspective on the relative advantages and disadvantages of various sizes of systems.

Size of Urbanized Area

Selected service factors and trends are next examined based on the size of the urbanized area. Urbanized areas are chiefly distinguished by varying densities, which both influence and are influenced by the urban transportation modes. As urbanized areas increase in population size, higher capacity modes are developed to transport people. High capacity modes are generally based on rail technology. Heavy rail is exclusively found in urbanized areas with over one million population. A full 4,111 out of 4,121 commuter rail vehicles serve urbanized areas with over one million population, and 95 percent of all light rail vehicles serve the largest urbanized areas. An increase in rail has not been the only response to congestion problems. Some urbanized areas have developed extensive networks of separate busways, which provide the commuter with the speed advantages of rail. Therefore, much of the discussion of service provided by size of urbanized area will refer to the information established during the discussions of modes and bus system sizes, as the mix of modes is often the key determinant of performance measures for an urbanized area.

Regions

The regions discussed in the NTST have been grouped for the similarity of climate and operating conditions. For example, the South-Southwest Region, as defined for the NTST, extends from North Carolina and Florida through Texas and New Mexico. Refer to Exhibit 2 for a map of the regions.

Service Effectiveness and Efficiency

Each chapter subdivides (by mode, UZA size, etc.) and combines the basic statistics to form relevant performance efficiency and effectiveness measures. Examples are passenger trips taken per vehicle hour and passenger fare revenue as a percentage of operating expense. Some indicators include trend information, while others focus on the current year of data. Further information and background on performance measures is provided on page 6, in the section on Assumptions.

Report Organization

The report organization has adopted the format of the Transit Profile. After an introduction, the NTST begins with a National Profile of the transit industry using aggregate data in summary form. The NTST continues with chapters concentrating on Service Consumption, Service Supplied, Operating Expenses, Operating and Capital Funding. It concludes with a chapter on Safety, Reliability and Maintenance Equipment.

Chapter 1: Profile of National Transit

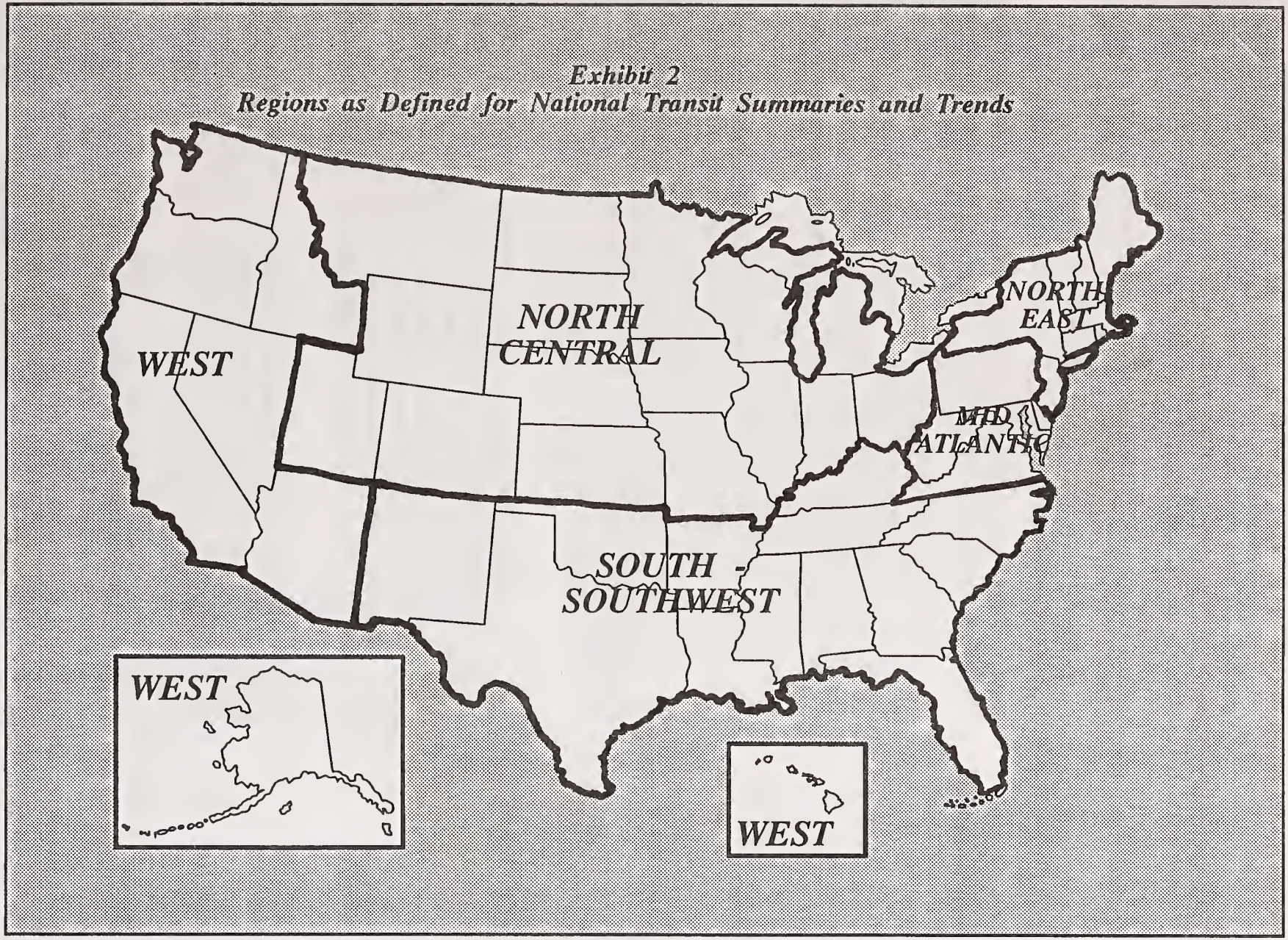
Chapter 1 provides an overview of the transit industry for 1990 by utilizing aggregate data in summary tabular and graphic formats. The chapter compiles data on the basis of national statistics and then reviews these statistics from several different perspectives, including three sizes of urbanized areas, five transit modes, and four categories of bus fleet size.

The National Profile follows the format of the Transit Profiles (published separately), which summarize key characteristics of individual transit agencies. Exhibit 4 provides aggregate statistical and financial information for the entire nation. The next three exhibits of the National Profile provide aggregate general and financial information by size of urbanized area (UZA size). The final profile exhibits portray transit characteristics by mode (Exhibit 8) and by size of bus fleet (Exhibit 9).

Chapter 2: Service Consumption

Chapter 2 focuses on the ultimate beneficiary of transit service, the customer. Effectiveness measures indicate how the service is used, compared to the resources required to provide service.

Exhibit 2
Regions as Defined for National Transit Summaries and Trends



The number of passenger trips taken (unlinked passenger trips) and the total miles traveled by those passengers (passenger miles) are measures of service used or consumed. Volumes of travel by mode and by type of service (directly operated and purchased transportation) reveal the multiple facets and extent of transit service in the country. Total ridership by size of bus fleet and by size of urbanized area suggests the critical role of transit in the nation's large cities. Performance measures such as average passenger trip length and average load factor contrast the differences between the modes. Key measures of service effectiveness, showing uses of service, include passenger trips per vehicle hour and per vehicle mile.

Chapter 3: Service Supplied

Chapter 3 focuses on the amounts and kinds of transit services provided. These are the outputs of transit systems' efforts.

Vehicle miles, vehicle hours, and the number of vehicles used in regular service are used to measure service supplied. Aggregate miles and hours reveal the magnitude of the transit service effort. Trends of increased service suggest increased efforts to attract more riders. Average vehicle speed and average annual miles traveled per vehicle characterize significant contrasting aspects of each mode.

Chapter 4: Operating Expenses

The cost of operating transit services is evaluated within the matrix of cost components: functions (vehicle operations, vehicle maintenance, etc.) and object classes (labor, materials, etc.). Service efficiency measures, which compare outputs to the resources required to produce them, include cost per vehicle revenue hour, cost per mile, and vehicle service hours per employee. Cost effectiveness measures, comparing customers to the required inputs, include cost per unlinked passenger trip and cost per passenger mile.

Chapter 5: Operating and Capital Funding

The NTST continues by examining the critical parameter of funding. Levels and means of funding frequently determine the levels of service. Sections on operating and capital assistance highlight Federal, State, and local trends in both areas. The size of an urbanized area determines its eligibility for various tiers of Federal assistance. Therefore, trends in sources of funding are examined in detail by UZA size. Graphs and tables present general blends of Federal, State, and local operating assistance and passenger fare revenues, contrasted by size of urbanized area and by region.

The most common cost-effectiveness measure associated with funding sources is passenger revenue compared to operating expense (revenue to cost ratio). A less common effectiveness measure, which compares revenues generated to service provided, is passenger revenue per vehicle mile. These measures are compared by size of urbanized area and by region.

The chapter examines trends in capital funding, in total and by size of urbanized area. Trends in average fleet age and spare ratios suggest intended or unintended results of capital funding. Miles of fixed guideway provide another indicator of the capital investment in mass transit on a national level.

Chapter 6: Safety, Reliability, and Maintenance Effectiveness

Accident and service interruption statistics provide indicators of passenger safety and service reliability. Collision and non-collision incidents are compared to vehicle miles and passenger miles as part of the safety evaluation. Trends in safety are not examined, due to significant changes in reporting forms and requirements for the 1990 reporting year.

Maintenance expense per vehicle mile, miles per maintenance employee, and miles between road calls (service interruptions) measure maintenance efficiency.

Assumptions and Report Applications

The NTST includes the 518 transit system reporters participating in the Section 15 program during 1990. Transit systems that are receiving Section 9 Federal Operating and/or Capital Assistance are required to report certain financial and operating statistics on an annual basis. Therefore, systems serving rural areas, which generally receive Section 18 or Section 16b2 capital or operating assistance, are not included in these reports. Likewise, private transportation providers are not included, unless they engage in subsidized contracts with public providers (called Purchased Transportation), or they file a limited report for private conventional and subscription bus services. Unless otherwise noted, all data refer to annual totals.

How Good are the Data?

The Section 15 data submitted to FTA by transit systems are subjected to extensive analysis and validation, both manual and automated. The process entails detailed examination of each transit system's report, the identification of errors or questionable entries, and direct resolution of these problems in conjunction with the reporting transit system.

FTA's role in this process is to identify and resolve questions of data completeness and accuracy and to give final approval to a system's data as a prerequisite to entry into the Section 15 database and annual report. FTA can reject a transit system's report if the report is not in full compliance with reporting requirements. FTA cannot change any reported data (all data changes must be made by the reporting transit system), but may choose not to enter any data items whose reliability are in question.

In general, the quality of the database improves each year as the FTA simplifies and clarifies definitions of data items and reporting procedures, and designs more sophisticated validation checks. Despite these extensive efforts, it should be noted that data validation encompasses primarily a review of the consistency and reasonableness of the reported data. Because of the limitations of these procedures, as well as the amount of data being validated, it is likely that some erroneous data have found their way into this report. In general, most errors of significant magnitude have been detected and corrected, but some relatively minor errors may remain. These errors generally are caused, not from the reporting or data processing procedures per se, but by: 1) difficulties experienced by transit systems in obtaining accurate information in certain instances; and 2) misinter-

pretation of certain data definitions. On occasion, a pairing of data items for a performance indicator for a single reporter is so far out of normal range that it causes a significant and highly visible distortion in the trend data for all reporters. Since this anomaly is not representative of all reporters, that single reporter's data will be deleted for that specific graph.

A word of caution: Because of these limitations and the fact that not all relevant information is reported (weather conditions, topography, work rules, etc.), users of this report should not draw unwarranted conclusions from the examination of the data contained herein. Although comparative evaluations are appealing, analyses of the reported data are not sufficient to account completely for apparent differences in performance. Such evaluations should encompass a more detailed examination of the underlying factors to determine the extent to which apparent differences are due to unique aspects of the transit system's operating environment, specific management practices, or unusual events during the period covered.

Census Information

Graphs and tables for breakouts by size of urbanized area use 1990 Census information for 1990, and use the 1980 Census for all other years. In other words, a city that moved from under 200,000 population to over 200,000 population would be represented in the under 200,000 data for 1987, 1988, and 1989, and moved into the over 200,000 bracket in 1990. Occasionally, this has generated significant shifts from one population bracket to another over time. These cases have been noted in the text. The census-related changes in Service Consumption are examined in Exhibit 28, Unlinked Passenger Trips by UZA Size. Changes in Service Supplied are examined in Exhibit 50, Vehicle Revenue Miles by UZA Size.

Inflation

All revenue and cost information is represented in dollars as reported. No scaling of data has been made to reflect the impact of inflation. The Consumer Price Index (Urban) increased from 115.4 in December, 1987, to 133.8 in December, 1990: an increase of 15.94 percent. Cost increases cited are compared to that increase in the CPI.

Frequent references are made to average annual increases over the four year period. These averages have been calculated from the base year to reflect the impact of compounding, and are not a simple average of the percentage increase. For example, a 24 percent increase over four years could be simply computed as eight percent per year (24/3). However, eight percent compounded yields an increase of 26 percent (1.08 * 1.08 * 1.08). Therefore, in the case of a 24 percent increase, NTST would show that the average annual increase is 7.5 percent, which yields an increase of approximately 24.2 percent compounded. This method is used consistently throughout the text. Percentage increases are generally rounded to one percentage place.

Rounding

Data has been presented as accurately as possible. In some cases, numbers may not add to the total, or percentages may not add to 100, due to rounding.

Calculation and Treatment of Joint Mode Expenses

The summaries of operating expenses by object class and mode (Exhibits 63, 64 and 65, Chapter 4) treat system joint mode expenses (which are allocated to each mode in a lump sum) as part of the object class Other. This understates labor, fringe benefit, service and materials expenses by mode, and overstates the Other object class. However, the alternative of ignoring joint mode expenses would understate total modal expenses; while the alternative of charging joint mode expenses to the Other mode greatly overstates the cost of that group of modes. The bottom of Exhibit 65, a table of expenses, presents the joint mode expenses by object class, and reconciles that table to other aggregations by object class.

Combination of Light Rail and Trolleybus

Light Rail (streetcar) and Trolleybus have been combined into a single mode for the purposes of this report. There are five Trolleybus systems in the country (three of the systems have over 50 vehicles) and 13 Light Rail systems (three of which have over 50 vehicles). Four of the five Trolleybus systems operate in cities that also have Light Rail.

Trolleybus represents a significant element of transit service in its respective cities. For example, San Francisco operates 262 trolleybuses and 101 light rail cars in maximum service. Seattle operates 109 trolleybuses and three light rail cars. Philadelphia operates 61 trolleybuses and 182 light rail cars. Boston operates 25 trolleybuses and 139 light rail cars. Dayton operates 26 trolleybuses and no light rail cars.

Light Rail itself is not a homogeneous mode. The Light Rail category includes old, established streetcar systems, such as those in New Orleans (where all of the vehicles are over 25 years old), Boston, Newark, Pittsburgh, Philadelphia, and San Francisco. Streetcars are electrically powered rail transit vehicles operating mostly on streets. However, their operation on congested streets causes friction with other vehicles, impeding both streetcar and automobile traffic. Therefore streetcars are not entirely analogous to Light Rail. Light Rail, generally represented by newer systems, uses predominantly reserved right of way, though not necessarily grade-separated right-of-way. Light Rail includes the new start systems, such as those in Buffalo, Portland, Sacramento, San Jose, and San Diego. Newer systems are more sophisticated than the older systems and have very different cost and operating characteristics. Some older systems (such as Pittsburgh, San Francisco, and Boston) are undergoing significant modernization efforts as well, which make comparisons even more difficult.

The overlap in various performance characteristics between the types of systems (such as passenger trips per mile and hour, average speed, hours and miles per vehicle, and operating cost per passenger mile), suggest significant similarities as well as differences. Operating cost per vehicle mile or hour is typically higher on Light Rail systems. Based on comments received, or as more Light Rail systems become operational, this aggregation may be eliminated, and Trolleybus mode may become separated from this category in future analyses.

In summary, NTST blends trolleybus, new light rail, and old streetcar systems into a single mode called Light Rail. The blended mode attains significance in terms of riders, miles of service, and operating expenses. However, conclusions or averages drawn from this merged data should be treated with caution. Analysts are advised to look at statistics for individual comparable systems, rather than the averages shown here, in performing any subsequent analysis.

Size of Bus Fleet: Example

The largest bus systems (over 250 buses) are found in the largest urbanized areas (generally over one million population, although Buffalo and Louisville, with less than one million population, have bus fleets exceeding 250 vehicles). However, smaller bus systems are not limited to smaller urbanized areas. Many large urbanized areas purchase service from smaller systems to provide commuter services. In addition, communities within a large urbanized area may operate their own neighborhood services. The Chicago area is an example of a large urbanized area that includes bus systems in each of the four categories: under 25, 25 to 99, 100 to 249, and 250 and over. The number of vehicles refers to vehicles in maximum service. DO refers to Directly Operated service, PT refers to Purchased Transportation. Small fleet size is a general indicator of small urbanized area; however, it is not a universal indicator.

Chicago RTA Transit Authority (CTA)	1,806 DO
Chicago RTA Suburban Bus Division	258 DO 116 PT
Chicago RTA PACE Contract Services - DuPage Motor Coach, Inc.	68 DO
Chicago RTA PACE Contract Services - Highland Park	5 DO
Chicago RTA PACE Contract Services - N. Suburban Mass Transit District	114 DO
Chicago RTA PACE Contract Services - Village of Niles	7 DO
Chicago RTA PACE Contract Services - Village of Wilmette	13 DO
East Chicago Public Transit	3 DO
Gary Public Transportation Corporation	30 DO
Hammond Transit System	9 PT
Hammond Yellow Coach Lines	21 DO

Vehicle Information for Total Fleet, Spare Ratios and Fleet Age

Data for this information was derived from different reporting forms in the Section 15 program. Total fleet information and spare ratios were derived from one set of forms, while fleet age information was aggregated from another form. As a result, vehicle counts may not be consistent within the Section 15 reporting system. There are several reasons for this:

- Vehicle inventories used to develop fleet age are based on fiscal year end data while total fleet inventories and spare ratios are computed from vehicles

available and required for maximum service. The spare ratio computation reflects the highest utilization during any portion of the year while inventory data reflects the number of vehicles added to or subtracted from the fleet at a given point in time.

- Vehicle type is not completely comparable to mode, but is used to calculate fleet age. The Demand Response mode uses several vehicle types. Buses used for this mode were aggregated in the Bus Mode to avoid double counting. This means that Demand Response fleet age data aggregates vans and autos as noted in the exhibit.

Information is compiled by type of service: Directly Operated and Purchased Transportation. Exhibit titles indicate whether information was compiled for one or both types of service.

Calculation of Data and Performance Measures

Performance measures use two data elements and have been calculated only for those reports that include both data elements, such as revenue miles and hours for calculating average speed. Therefore, the performance measures displayed on the tables herein will not always coincide perfectly with performance measures calculated from displayed data. The number of systems represented also may vary slightly from one graph to the next. The exception to this rule is in Chapter 1, Profile of National Transit, where performance measures were calculated directly from the data in the table.

Performance Measures: Context for Analysis

Section 15 reporting requirements contribute to a very extensive database of information. Many measurements of transit performance (for individual transit systems as well as for the nation as a whole) can be derived from this information. However, the various measurements and ratios developed in the NTST or for an individual system should not be considered in isolation. Transit system characteristics can be classified into four general categories:

- System Performance;
- Level of Service;
- Impacts; and
- Costs.

(See "Urban Passenger Transport Modes," pp. 76-77 by Vukan R. Vuchic, *Public Transportation: Planning, Operations, and Management,* Prentice Hall, 1979.)

- *System Performance* includes service frequency, operating speed, reliability (on-time performance), safety, line capacity, productive capacity, productiv

ity, and utilization. Section 15 data can measure some, but not all, aspects of system performance, namely:

- Operating speed (average speed): see Chapter 3, Service Supplied;
- Safety (incidents, injuries, or fatalities per vehicle mile or passenger mile): see Chapter 6, Safety and Reliability and Maintenance Effectiveness;
- Productivity (operating cost per vehicle mile or vehicle hour, also called measures of service efficiency), operating cost per unlinked passenger trip or per passenger mile (also called measures of cost effectiveness), vehicle revenue hours per employee: see Chapter 4, Operating Expenses; or vehicle revenue miles per maintenance employee: see Chapter 6, Service and Reliability and Maintenance Effectiveness; and Utilization (passenger trips or passenger miles per vehicle mile or vehicle hour, also called measures of service effectiveness): see Chapter 2, Service Consumption.

- *Level of Service* is the general measure of all service characteristics that affect users of the service.
  - Level of Service includes service quality, such as convenience, simplicity, comfort and cleanliness. These aspects are not represented in Section 15 Reports because they are more subjective than objective, and are difficult to quantify and define on a national level.
  - Level of Service also includes performance elements that affect users, such as operating speed, reliability, and safety. Reliability from the user standpoint is generally considered to be on-time performance. However, Section 15 reports use a surrogate for reliability: road calls or service interruptions due to mechanical breakdowns or other causes. Again, Operating speed is discussed in Chapter 3, Service Supplied, while Safety and Reliability are discussed in Chapter 6.

- *Impact* is the effect transit service has on its surroundings and the entire area it serves. This includes short-term impacts, such as changes in air pollution, noise or traffic congestion, and long-term impacts such as changes in land values, physical form, and social environment. Section 15 data is not designed to capture such impacts on either a local or a national scale.

- *Costs* are divided into capital and operating costs.
  - Capital costs represent investments in construction or the physical plant of the transit system. Section 15 data collects information on the sources of capital expenditures (Federal, State, and local). Only indirectly does it capture the uses of capital funds, as evidenced in changes in the average age of the fleet, spare ratios, and miles of fixed guideway. (See Chapter 5, Operating and Capital Funding.) However, future reporting (beginning with the 1991 Report Year) has been enhanced to rectify this problem.

- Operating costs are costs incurred by regular operation of the system. Operating costs are a major element of the Section 15 database, with both functional and object class distributions. For example, users of Section 15 information can distinguish the salaries and fringe benefits incurred for vehicle maintenance from salaries and fringe benefits for vehicle operations or administration. This information also exists for each mode of service. (See Chapter 4, Operating Expenses.)

Section 15 also collects funding sources for operations. The major categories are passenger fares, Federal funding, State funding, local funding, and other sources of funding, in particular funding dedicated to transit at its source. Each agency collects greater detail (also included in the database), such as full adult fares, special fares for the elderly and disabled, local assistance to reduce fares for the elderly and disabled, etc.

A comprehensive evaluation and comparative analysis of transit systems should include all four categories: performance, level of service, impacts, and cost of each system. Since Section 15 does not capture all types of information, the analysis made here is, by definition, incomplete. However, even in using the information presented here, the reader is advised that no single measure is complete. The preferred mode, for example, for any certain set of circumstances is not necessarily the one with the highest performance or the lowest cost for any given measure. As will be seen, the rankings vary significantly among modes, sizes of system, size of urbanized area, and region, depending on the particular measure being discussed.

Performance Measures: Which are Most Important?

Performance measures are generally divided into three main categories: efficiency, effectiveness, and impact measures. Impact measures, such as achievement of social, environmental, and energy conservation objectives, are not amenable to evaluation within the framework of the Section 15 database. Therefore, efficiency and effectiveness measures are the focus of the NTST.

Efficiency measures compare inputs, such as dollars or labor, to outputs produced, such as miles or hours of service. Cost effectiveness measures compare inputs (dollars or labor) to the end product, the service to the public (passenger trips or passenger miles). Service effectiveness measures compare the end product, such as passenger trips or passenger miles, to the service outputs, such as miles or hours of service.

There is no national consensus on the most important indicators. However, some indicators are more prevalent than others, which suggest greater importance.

Federal triennial reviews use seven indicators (see Exhibit 3.)

Transit Profiles, a new set of FTA publications, uses six indicators to compare performance trends by mode within each agency. Chapter 1 of the NTST aggregates information by mode and by size of bus fleet in the same style as individual system Transit Profiles, using the same six indicators (see Exhibits 8

Exhibit 3
Performance Measures in Perspective

Measures	Federal Triennial Review	Transit Profiles	Fielding, Babitsky, Brenner (1985)	Pennsylvania	California	Los Angeles
Efficiency						
Overall	Vehicle Revenue Hours per Dollar Operating Cost	Operating Expense per Vehicle Revenue Hour Operating Expense per Vehicle Revenue Mile	Vehicle Revenue Hours per Dollar Operating Cost Vehicle Miles per Peak Vehicle	Cost per Hour	Operating Expenses per Vehicle Service Hour	Operating Expense per Vehicle Service Hour
Labor	Vehicle Hours per Employee Vehicle Miles per Maintenance Employee		Vehicle Miles per Total Employee		Vehicle Service Hours per Employee	
Maintenance	Vehicle Miles per Dollar Maintenance		Vehicle Miles per Maintenance Employee			
Effectiveness						
Overall	Passengers per Vehicle Revenue Hour	Unlinked Passenger Trips per Vehicle Revenue Hour Unlinked Passenger Trips per Vehicle Revenue Mile	Passenger Revenue Per Vehicle Hour	Ridership per Hour Revenue per Hour	Passengers per Vehicle Service Hour Passengers per Vehicle Service Mile	Passengers per Vehicle Service Hour
Safety	Vehicle Miles per Collision Accident		Vehicle Miles per Collision Accident			
Cost Effectiveness						
Overall Ratio	Operating Revenue per Operating Expense		Operating Revenue per Operating Expense	Revenue to Expense Ratio		Operating Revenue per Operating Expense
Passenger Ratio		Operating Expense per Unlinked Passenger Trip Operating Expense per Passenger Mile			Operating Expense per Passenger	Subsidy per Passenger

and 9). Performance measures by mode do not present the revenue-to-cost ratio found in most other collections of performance measures, because transit systems do not universally report revenue by mode.

Fielding, Glauthier, and Lave identified 22 efficiency, effectiveness, and cost effectiveness indicators in 1978. The list narrowed to seven indicators in a subsequent 1985 study (Fielding, 1991, pp. 6 and 7). Those indicators are noted on the following table.

The Commonwealth of Pennsylvania has adopted four measures in its performance evaluation incentive efforts: cost per hour, revenue per hour, ridership per hour, and the revenue-to-expense ratio. (Fielding, 1991, pp. 9 and 10.) The State of California has adopted five indicators, while Los Angeles has adopted four, two of which coincide with the overall California measures.

The NTST includes most of these indicators. Some are reviewed by the parameters of mode, size of bus fleet, UZA size and region. Others may be limited to one or two parameters. Additional measures presented, such as average passenger trip length, average vehicle operating speed, peak to base ratios, spare ratios, and average fleet age, provide perspective on the similarities and differences between modes, system sizes, etc.

(Source for information on indicators other than Transit Profiles: Draft Preprint Paper No. 92-0707, *Transit Performance Evaluation in the U.S.A.*, by Gordon J. Fielding, School of Social Sciences, University of California, Irvine; paper presented at the Transportation Research Board 71st Annual Meeting, 1992.)

Additional Information on The Section 15 Reporting System

The following FTA documents provide a more detailed description of the Section 15 reporting system:

Urban Mass Transportation Industry Uniform System of Accounts and Records and Reporting System, January 10, 1977, Volume II - Uniform System of Accounts and Records.

- Volume II contains the definitions used for the uniform system of accounts and records.

Reporting Manual and Sample Forms (All Reporting Levels), revised April 1990.

Changes/Errata Sheet, 1990 Reporting Manual, revised September 15, 1990.

FTA Circular 2710.1A, *Sampling Procedures for Obtaining Fixed Route Bus Operating Data Required Under the Section 15 Reporting System*, July 18, 1988.

FTA Circular 2710.2A, *Sampling Procedures for Obtaining Demand Responsive Bus Operating Data Required Under the Section 15 Reporting System*, July 22, 1988.

FTA Circular 2710.4A, *Revenue Based Sampling Procedures for Obtaining Fixed Route Bus Operating Data Required Under the Section 15 Reporting System*, July 22, 1988.

- These three circulars suggest optional sampling procedures for collecting unlinked passenger trip and passenger mile data required for Section 15 reports. Complete instructions and worksheets are provided for those transit systems wishing to use these procedures.

FTA Circular 9030.1A, *Section 9 Formula Grant Application Instructions*, September 18, 1987.

- This circular provides guidance on how to apply for grants under the Section 9 formula grant program. It also discusses the use of Section 15 data in the computation of Section 9 apportionments.

Data User's Guide to the FTA Section 15 Reporting System, Transportation Systems Center, June 1, 1989.

- The User's Guide is available through the McTrans Center. Telephone (904) 392-0378. The other documents are available upon request through:

  Federal Transit Administration
  Office of Capital and Formula Assistance
  Audit Review and Analysis Division
  P.O. Box 61126
  Washington D.C. 20039-1126
  (301) 588-9676

Industry-Government Cooperation

The Section 15 Reporting System evolved from the transit industry-initiated Project "**FARE**" (Uniform **F**inancial **A**ccounting and **R**eporting **E**lements.) Over the years, a cooperative working arrangement has developed between the transit industry and the Federal government on the Section 15 data collection and reporting system. The private and public sectors have recognized the importance of and need for timely and accurate data on which to assess the continued progress of the nation's mass transportation systems.

In January 1983, the FTA Section 15 Reporting System Advisory Committee was established to make recommendations on improving the quality and usefulness of the data collected under the Section 15 program. Many of the past improvements to the annual report are the results of the Advisory Committee's recommendations. The Advisory Committee's charter expired on September 30, 1986. FTA continues to work closely with individuals and organizations in the transit industry to improve the Section 15 reporting system and its annual report.

To help promote this cooperative effort, FTA urges all interested parties, including transit operators, State and local governments, planning organizations, trade unions, research organizations, and others to review and critique this 1990 edition of the *National Transit Summaries and Trends*. Comments and suggestions should be forwarded to:

Federal Transit Administration
Office of Capital and Formula Assistance
Audit Review and Analysis Division
P.O. Box 61126
Washington D.C. 20039-1126
(301) 588-9676

The data contained in the individual transit system statistics tables (i.e., Chapter 3 for report years 1983 through 1989; and Chapter 2 for report year 1990) in the Section 15 Annual Report are available on floppy diskettes for use on microcomputers. These diskettes (double sided) are organized by report table and are compatible for use on an IBM-PC using Lotus 1-2-3 software. They contain the actual data reported by transit systems in cases of questionable data, not the "Q" found in the 1984 through 1987 annual reports. In the 1988 and 1989 diskettes, the value of the data is included followed by a "Q" for questionable data. In addition, diskette sets organized by fleet size are available for report year 1981 only. These sets are available in either an Apple II DIF format or a single-sided IBM-PC DIF format. For further information on diskette availability and costs, please contact:

McTrans Center
512 Weil Hall
University of Florida
Gainesville, FL 32611-9988
(904) 392-0378

Complete Section 15 data (including required-level data not published in this report), all voluntary-level data, and data for prior reporting years are also available on magnetic tapes. For further information, please call the Transportation Systems Center in Cambridge, Massachusetts at (617) 494-2938, or write to:

U.S. Department of Transportation
Transportation Systems Center
DTS-49, Kendall Square
Cambridge, MA 02142

Chapter 1

Profile of National Transit

Introduction

The National Transit Profile, Exhibit 4, provides aggregate general and financial transit information for the United States in 1990. General information includes Service Consumed, Service Supplied, and the Number of Vehicles Operated in Maximum Service. Financial information includes the Sources of Operating Funds, Summary of Operating Expenses, and Sources of Capital Funds Expended. In addition, two pie graphs at the bottom of each page depict the Sources of Operating Funds and Sources of Capital Funds Expended.

The next three exhibits of the National Transit Profile (Exhibits 5, 6, and 7), provide the same categories of information subdivided by size of urbanized area (UZA size). The three population categories for urbanized areas are: under 200,000, 200,000 to one million, and over one million. These population categories are also the separation points for various categories of Federal operating and capital assistance.

The final two exhibits of the Profile (Exhibits 8 and 9) portray transit characteristics by mode and by size of bus fleet. The five modes shown are Bus, Heavy Rail, Commuter Rail, Light Rail, and Demand Response. Two modes are shown on each page. The four categories for Sizes of Bus Fleets, based on the number of buses in maximum service, are: Fewer than 25, 25 to 99, 100 to 249, and 250 or more. Specific financial and service characteristics are listed for each mode and size of bus fleet. Performance measures are derived from individual characteristic data. The performance measures indicate service efficiency, cost effectiveness, and service effectiveness for each mode and size of bus fleet. In addition, line graphs at the bottom of each page depict trend data from 1987 through 1990 for selected performance measures.

National Profile

The National Transit Profile for 1990 (Exhibit 4) provides an overview of the transit industry for 1990 in terms of service consumed, service supplied, operating revenue, operating expenses, and capital funding. The following highlights and trends are identified:

Service Consumption

The demand for transit has remained stable since 1987. Transit patrons in the United States made almost 8 billion trips in 1990. Each weekday, passengers averaged almost 27 million trips. This is the equivalent of 32 trips for every person in the country.

These passengers traveled about 38 billion miles in 1990. This volume of travel has remained nearly constant over the past four years. Travel averaged 151 miles on a per capita basis.

Service Supplied

The transit industry provided almost two and a half billion service miles to carry its patrons. This equates to driving from New York to Los Angeles 2,425 times a day, 365 days a year. Service provided has increased steadily since 1987. Total miles in 1990 were seven percent higher than the 1987 level.

Exhibit 4
National Transit Profile

General Information (System Wide)

Service Consumption (millions)

Annual Unlinked Trips	7,965.6
Annual Passenger Miles	37,990.8
Average Weekday Unlinked Trips	26.9
Average Saturday Unlinked Trips	13.6
Average Sunday Unlinked Trips	8.1

Service Supplied

Annual Vehicle Revenue Miles (millions)	2466.8
Annual Vehicle Revenue Hours (millions	168.9
Total Fleet	81,706
Vehicles Operated in Maximum Service	65,142
Base Period Requirement	28,338

Vehicles Operated in Maximum Service by Type of Service and Number of Systems Reporting by Mode*

	Directly Operated		Purchased Trans.	
	Vehicles	Systems	Vehicles	Systems
Bus	40,840	362	2,029	79
Heavy Rail	8,347	12	0	0
Commuter Rail	3,922	10	241	8
Light Rail	1,144	14	4	1
Demand Response	2,627	152	5,276	189
Other	630	24	82	8

* The total number of systems reporting is 518, of which 282 reported two or more modes.

Financial Information (System Wide)

Sources of Operating Funds (milllions)

Passenger Fares		5,592.7
Local Assistance		3,764.2
State Assistance		2,858.9
Federal Assistance		822.0
Other Revenues		2,198.9
Total Operating Funds	**(1990)**	**15,236.7**

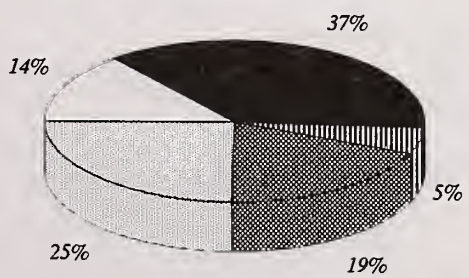
Summary of Operating Expenses (millions)

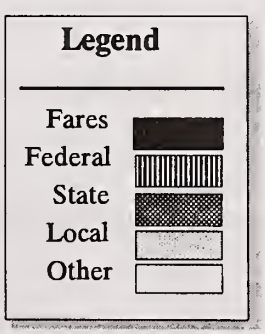
Salaries/Wages/Benefits		10,575.9
Materials & Supplies		1,472.1
Purchased Transportation		884.9
Other Expenses		1,781.7
Total Operating Expenses	**(1990)**	**14,714.6**

Sources of Capital Funds Expended (millions)

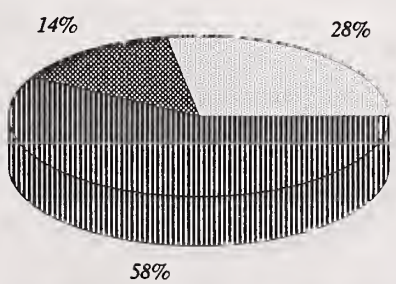
Local Assistance		1,254.2
State Assistance		644.6
FTA Sec. 3 Discretionary	853.2	
FTA Sec. 9 Formula	1,284.0	
FTA Other Assistance	428.0	
Other Federal Assistance	71.5	
Federal Assistance Total		2,636.7
Total Capital Funds Expended	**(1990)**	**4,535.5**

Sources of Operating Funds





Sources of Capital Funds Expended



Transit required over 65,000 vehicles to operate at its maximum level of service. In addition, the transit fleet included another 16,000 vehicles (an additional 25 percent) to be used as spares and to exchange for routine or extensive maintenance. Spares required for directly operated service averaged 23 percent.

Operating Funding

The country as a whole spent $15.2 billion to operate transit service, or less than $60 per capita. Patrons provided almost 37 percent of the funding through passenger fares. State and local governments paid about 58 percent of the cost, and the Federal government contributed five percent.

Operating Expenses

Total operating expenses increased by 19 percent from 1987 to 1990, averaging about six percent per year. The effect of increased service can be factored in by means of an indicator such as cost per vehicle mile. Cost per mile from 1987 to 1990 increased less than 12 percent, or less than four percent per year. The Consumer Price Index increased almost 16 percent over the same period.

Approximately 72 percent of the cost of service was for employee salaries, wages, and benefits. Another six percent was spent to purchase transportation service, in contrast to directly operating service. Spending on purchased transportation increased by 45 percent from 1987 to 1990, with the greatest growth occurring for Demand Response services.

Capital Funding

Public sources provided over $4.5 billion in capital assistance, in addition to operating assistance, during 1990. The Federal government contributed over 58 percent of these funds. Total funding for capital assistance increased by 28 percent since 1987; Federal funding, by 11 percent; State and local funding, by 64 percent. One result of this investment was a marked decrease in the average age of the nation's fleet of vehicles.

National Transit Profiles by Size of Urbanized Area

The Profiles by Size of Urbanized Area (Exhibits 5, 6, and 7) depict the U.S. transit industry in 1990 from the perspective of small, medium, and large UZAs.

Overview - Urbanized Areas Less Than 200,000 Population

Small UZAs, Exhibit 4 (less than 200,000 population):

- Provided less than seven percent of transit vehicle miles;
- Served less than three percent of combined passenger trips;
- Spent about three percent of combined operating funds for transit;

Exhibit 5
National Transit Profile for Urbanized Areas Less Than 200,000 Population

General Information (System Wide)

Service Consumption (millions)

Annual Unlinked Trips	220.6
Annual Passenger Miles	799.7
Average Weekday Unlinked Trips	1.1
Average Saturday Unlinked Trips	0.4
Average Sunday Unlinked Trips	0.1

Service Supplied

Annual Vehicle Revenue Miles (millions)	150.2
Annual Vehicle Revenue Hours (millions)	11.4
Total Fleet	6,462
Vehicles Operated in Maximum Service	5,126
Base Period Requirement	1,812

Vehicles Operated in Maximum Service by Type of Service and Number of Systems Reporting by Mode *

	Directly Operated		Purchased Trans.	
	Vehicles	Systems	Vehicles	Systems
Bus	3,053	170	233	22
Heavy Rail	0	0	0	0
Commuter Rail	0	0	0	0
Light Rail	0	0	4	1
Demand Response	666	70	1,061	90
Other	108	5	1	0

* The total number of systems reporting is 208, of which 126 report two or more modes.

Financial Information (System Wide)

Sources of Operating Funds (millions)

Passenger Fares		$86.9
Local Assistance		104.6
State Assistance		89.8
Federal Assistance		89.8
Other Revenues		47.0
Total Operating Funds	**(1990)**	**$418.2**

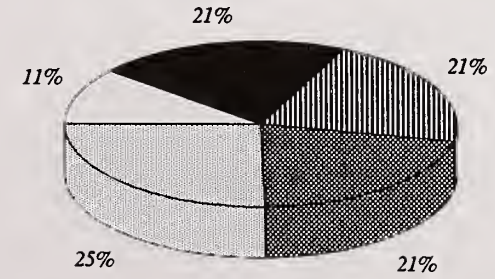
Summary of Operating Expenses (millions)

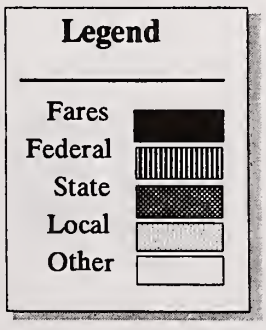
Salaries/Wages/Benefits		$253.1
Materials & Supplies		56.1
Purchased Transportation		34.5
Other Expenses		59.7
Total Operating Expenses	**(1990)**	**$403.4**

Sources of Capital Funds Expended (millions)

Local Assistance		$19.1
State Assistance		15.3
FTA Sec. 3 Discretionary	17.3	
FTA Sec. 9 Formula	44.9	
FTA Other Assistance	1.2	
Other Federal Assistance	0.2	
Federal Assistance Total		63.6
Total Capital Funds Expended	**(1990)**	**$98.0**

Sources of Operating Funds





Sources of Capital Funds Expended

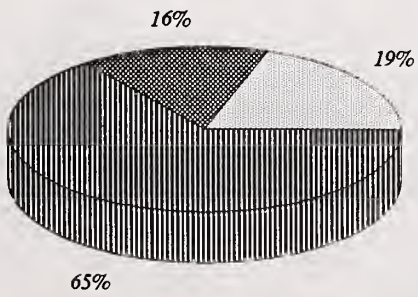


Exhibit 6
National Transit Profile for Urbanized Areas from 200,000 to 1 Million Population

General Information (System Wide)

Service Consumption (millions)

Annual Unlinked Trips	669.8
Annual Passenger Miles	2,662.0
Average Weekday Unlinked Trips	2.3
Average Saturday Unlinked Trips	1.1
Average Sunday Unlinked Trips	0.4

Service Supplied

Annual Vehicle Revenue Miles (millions)	328.6
Annual Vehicle Revenue Hours (millions)	23.7
Total Fleet	13,175
Vehicles Operated in Maximum Service	10,243
Base Period Requirement	4,427

Vehicles Operated in Maximum Service by Type of Service and Number of Systems Reporting by Mode *

	Directly Operated		Purchased Trans.	
	Vehicles	Systems	Vehicles	Systems
Bus	7,700	94	311	22
Heavy Rail	0	0	0	0
Commuter Rail	0	0	10	1
Light Rail	49	2	0	0
Demand Response	726	49	1,300	57
Other	113	6	34	5

* The total number of systems reporting is 116, of which 82 report two or more modes.

Financial Information (System Wide)

Sources of Operating Funds (millions)

Passenger Fares		$289.1
Local Assistance		319.7
State Assistance		175.8
Federal Assistance		158.4
Other Revenues		195.8
Total Operating Funds	**(1990)**	**$1,138.8**

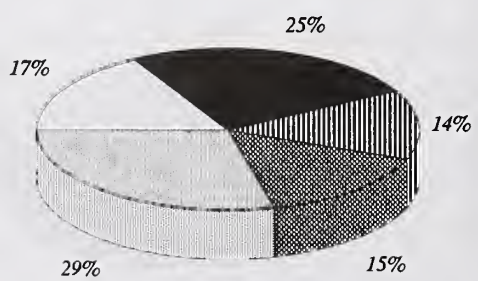
Summary of Operating Expenses (millions)

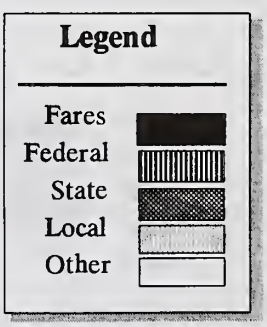
Salaries/Wages/Benefits		$754.5
Materials & Supplies		147.7
Purchased Transportation		94.1
Other Expenses		143.1
Total Operating Expenses	**(1990)**	**$1,139.4**

Sources of Capital Funds Expended (millions)

Local Assistance		$91.5
State Assistance		21.2
FTA Sec. 3 Discretionary	10.2	
FTA Sec. 9 Formula	153.6	
FTA Other Assistance	1.9	
Other Federal Assistance	1.1	
Federal Assistance Total		166.8
Total Capital Funds Expended	**(1990)**	**$279.5**

Sources of Operating Funds





Sources of Capital Funds Expended

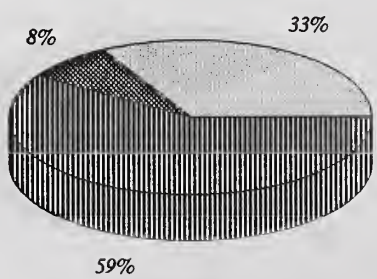


Exhibit 7
National Transit Profile for Urbanized Areas
Over 1 Million Population

General Information (System Wide)

Service Consumption (millions)	
Annual Unlinked Trips	7,075.1
Annual Passenger Miles	34,529.0
Average Weekday Unlinked Trips	23.4
Average Saturday Unlinked Trips	12.1
Average Sunday Unlinked Trips	7.6

Service Supplied	
Annual Vehicle Revenue Miles (millions)	1,988.0
Annual Vehicle Revenue Hours (millions)	133.8
Total Fleet	59,192
Vehicles Operated in Maximum Service	49,773
Base Period Requirement	22,099

Vehicles Operated in Maximum Service by Type of Service and Number of Systems Reporting by Mode *

	Directly Operated		Purchased Trans.	
	Vehicles	Systems	Vehicles	Systems
Bus	30,087	98	1,485	35
Heavy Rail	8,347	12	0	0
Commuter Rail	3,922	10	231	8
Light Rail	1,095	12	0	0
Demand Response	1,235	33	2,915	42
Other	409	13	47	3

* The total number of systems reporting is 194, of which 74 report two or more modes.

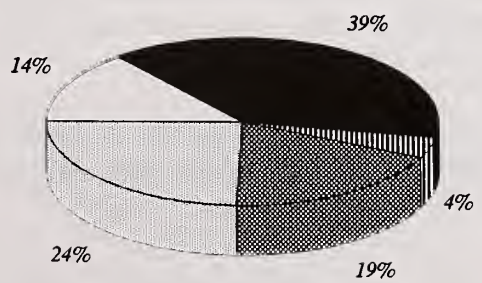
Financial Information (System Wide)

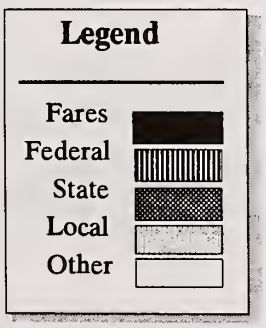
Sources of Operating Funds (millions)		
Passenger Fares		$5,216.7
Local Assistance		3339.9
State Assistance		2593.4
Federal Assistance		573.7
Other Revenues		1956.1
Total Operating Funds	**(1990)**	**$13,679.8**

Summary of Operating Expenses (millions)		
Salaries/Wages/Benefits		$9,568.3
Materials & Supplies		1268.3
Purchased Transportation		756.3
Other Expenses		1578.9
Total Operating Expenses	**(1990)**	**$13,171.8**

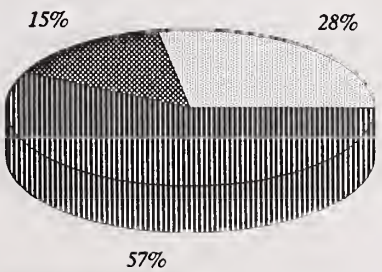
Sources of Capital Funds Expended (millions)		
Local Assistance		$1,143.6
State Assistance		608.0
FTA Sec. 3 Discretionary	825.7	
FTA Sec. 9 Formula	1085.5	
FTA Other Assistance	424.9	
Other Federal Assistance	70.3	
Federal Assistance Total		2406.4
Total Capital Funds Expended	**(1990)**	**$4,158.0**

Sources of Operating Funds





Sources of Capital Funds Expended



- Received almost 11 percent of all Federal operating assistance, and
- Represented over 40 percent of the systems reporting.

Overview - Urbanized Areas from 200,000 to One Million Population

Mid-sized UZAs, Exhibit 6 (200,000 to one million population):

- Provided about 13 percent of transit vehicle miles;
- Served about seven percent of combined passenger trips;
- Spent about seven percent of combined operating funds committed to transit;
- Received about 19 percent of all Federal operating assistance, and
- Represented about 20 percent of the systems reporting.

Overview - Urbanized Areas Over One Million Population

Large UZAs, Exhibit 7 (over one million population):

- Provided over 80 percent of transit vehicle miles;
- Served almost 90 percent of combined passenger trips;
- Spent about 90 percent of combined operating funds committed to transit;
- Received about 70 percent of all Federal operating assistance, and
- Represented less than 40 percent of the systems reporting.

Large UZAs, with over one million population, by far dominated the transit industry in the categories of service provided, service consumed, and resources required to fund the service.

The graphs at the bottom of each page display additional facets of the UZA profile.

Sources of Operating Funding

Small UZAs relied on Federal funding for about 21 percent of operating funding; passengers bore almost the same proportional burden. State and local sources (including Other Revenues) funded 58 percent of operations.

Mid-sized UZAs relied on Federal funding for almost 14 percent of operating funding. Passengers contributed 25 percent of the cost, while State and local

governments and dedicated revenue sources contributed 61 percent toward operations.

Large UZAs obtained higher passenger participation toward the cost of service. Passenger fares covered 38 percent of funding, while Federal assistance accounted for four percent. State and local sources contributed 58 percent toward operations.

Large UZAs did not receive Federal operating assistance proportional to their share of expenses, passengers, passenger miles, and vehicle miles and hours. However, they commanded the largest share of Federal funding, receiving almost 70 percent of total Federal operating assistance.

Sources of Capital Funding

These graphs reveal the critical and dominant role of Federal funding in terms of infrastructure maintenance and improvement.

- The Federal government, primarily through the FTA, provided almost 60 percent of capital funding, which went to replacing buses and other rolling stock, rebuilding facilities and track, and enabling entire new systems to be built.

- Small and medium size UZAs relied heavily on Section 9 funds, which the FTA distributed based on a Congressionally mandated formula. For 1990, Section 9 funds represented 46 percent of all capital funding for small UZAs, and 55 percent of all capital funding for mid-sized UZAs. Discretionary and other Federal funds contributed 19 percent of 1990 capital funding for small UZAs, and five percent of capital funding for mid-sized UZAs. State and local sources contributed 35 percent of capital funding for small UZAs, and 40 percent for mid-sized UZAs.

- Large UZAs received about 90 percent of all Federal capital assistance. Section 9 capital assistance funded about 26 percent of total 1990 capital expenditures for large UZAs. Section 3 (discretionary) funds and other Federal funds provided about 26 percent of the funding. These other Federal funds primarily included other FTA funds and Federal Highway transfers. State and local sources contributed 42 percent toward capital expenditures.

National Transit Profile by Mode and Size of Bus Fleet

The National Transit Profiles by Mode and Size of Bus Fleet (Exhibits 8 and 9) offer summaries of salient characteristics and performance measures. Characteristics include total operating expense, measures of service consumed and service supplied, fixed guideway directional route miles and vehicle information. Performance measures include service efficiency (the cost of providing a unit of service supplied), cost effectiveness (the cost of providing a unit of service consumed), and service effectiveness (units of service consumed compared to units of service provided). Line graphs at the bottom of each page depict the four-year

trend in three of the six performance measures for each mode and size of bus system.

The modes evaluated from a national perspective include Bus, Heavy Rail (formerly called Rapid Rail), Commuter Rail, Light Rail (formerly called Streetcar, and including Trolleybus in this analysis), and Demand Response.

The number of vehicles in maximum service defines the size of a bus fleet. The four categories are: systems with fewer than 25 vehicles, systems with 25 to 99 vehicles, systems with 100 to 249 vehicles, and systems with over 250 vehicles.

Profile by Mode

Exhibit 8 profiles the national transit industry in terms of modal characteristics. The exhibits reveal that Bus was the predominant mode, whether from the perspective of service provided, service consumed, or service expense.

Characteristics

Buses supplied 62 percent of all vehicle revenue miles and 71 percent of all vehicle revenue hours. Passengers on buses accounted for 62 percent of unlinked passenger trips and 48 percent of passenger miles. Bus required 53 percent of all operating expense.

Heavy Rail supplied 21 percent of all vehicle revenue miles and 16 percent of all vehicle revenue hours. Passengers on Heavy Rail accounted for 29 percent of unlinked passenger trips and 30 percent of passenger miles. Heavy Rail consumed 26 percent of all operating expense.

Commuter Rail supplied eight percent of all vehicle revenue miles and four percent of all vehicle revenue hours. Commuter Rail passengers accounted for four percent of unlinked passenger trips and 19 percent of passenger miles. Commuter Rail required 15 percent of all operating expense.

Light Rail supplied two percent of all vehicle revenue miles and hours. Light Rail passengers accounted for four percent of unlinked passenger trips and two percent of passenger miles. Light Rail required two percent of all operating expense.

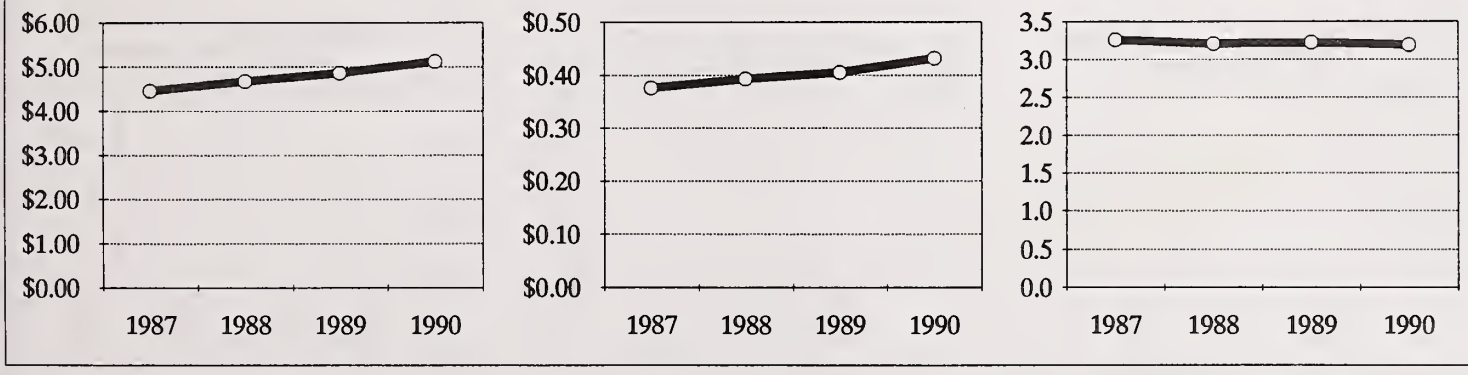
Demand Response supplied seven percent of all vehicle revenue miles and hours. Passengers on Demand Response vehicles accounted for less than one percent of unlinked passenger trips and passenger miles. Demand Response required three percent of all operating expense.

Totals for modes (numbers and percentages) will not equal national totals because several modes that fall into the category Other are not represented. Other modes include aerial tramway, automated guideway, cable car, ferryboat, inclined plane, and vanpool. Together, they represent less than 0.5 percent of all vehicle hours and miles, less than one percent of all unlinked passenger trips and passenger miles, and less than two percent of operating expense.

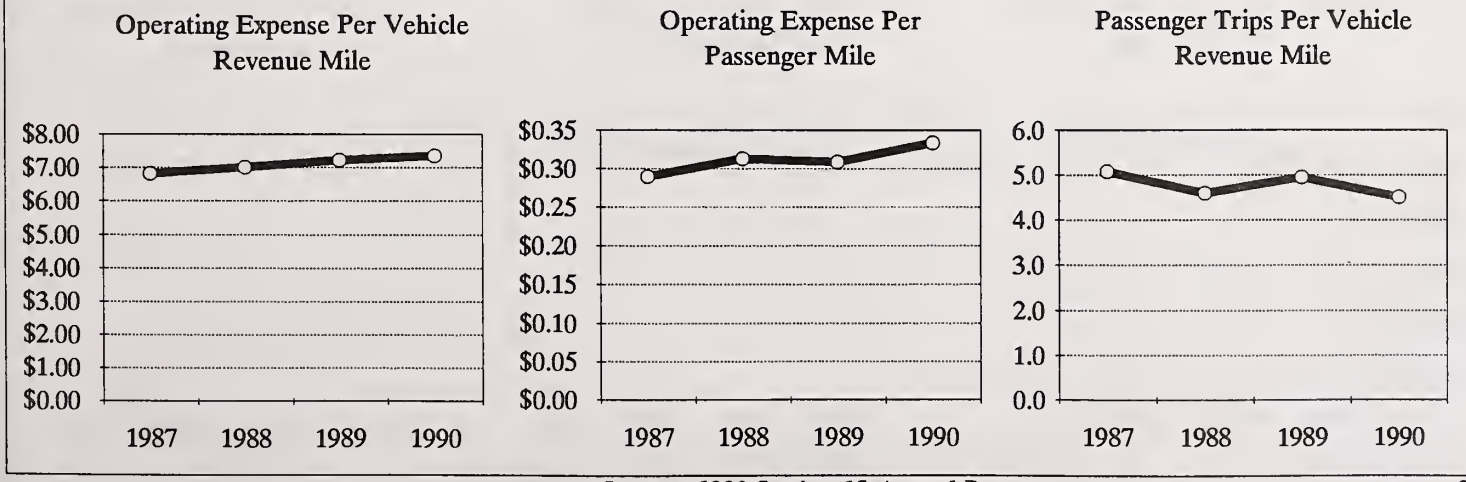
Exhibit 8 National Transit Profile by Mode

Characteristics	Bus	Heavy Rail
Operating Expense (millions)	7,788.6	3,825.0
Annual Unlinked Trips (millions)	4,887.1	2,346.3
Annual Passenger Miles (millions)	18,069.5	11,475.3
Average Weekday Unlinked Trips (millions)	16.7	7.8
Annual Vehicle Revenue Hours (millions)	120.1	26.3
Annual Vehicle Revenue Miles (millions)	1,534.5	520.8
Fixed Guideway Directional Route Miles	172,348.0	1,350.6
Total Fleet (Directly Operated Service)	50,231	10,313
Vehicles Operated in Maximum Service (Directly Operated Service)	40,840	8,347
Peak to Base Ratio	1.8	1.8
Spare Ratio (Directly Operated Service)	25%	24%
Performance Measures		
Service Efficiency		
Operating Expense/Vehicle Revenue Hour	$65.16	$145.44
Operating Expense/Vehicle Revenue Mile	$5.10	$7.34
Cost Effectiveness		
Operating Expense/Unlinked Passenger Trip	$1.60	$1.63
Operating Expense/Passenger Mile	$0.43	$0.33
Service Effectiveness		
Unlinked Passenger Trips/Vehicle Revenue Hour	40.7	89.2
Unlinked Passenger Trips/Vehicle Revenue Mile	3.2	4.5

Bus



Heavy Rail

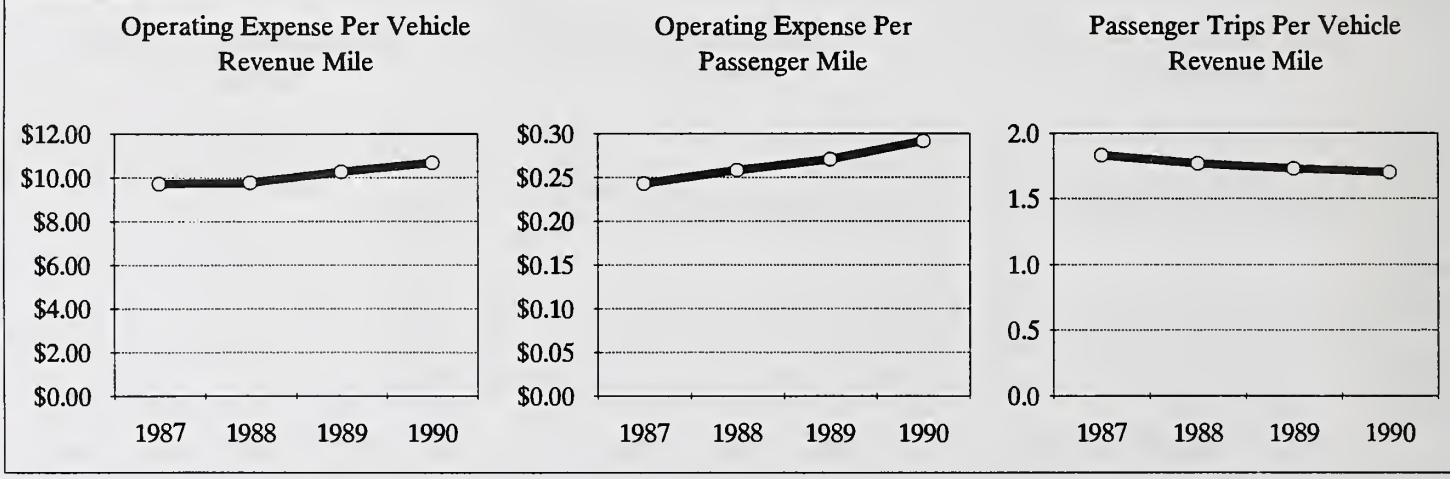


Source: 1990 Section 15 Annual Report

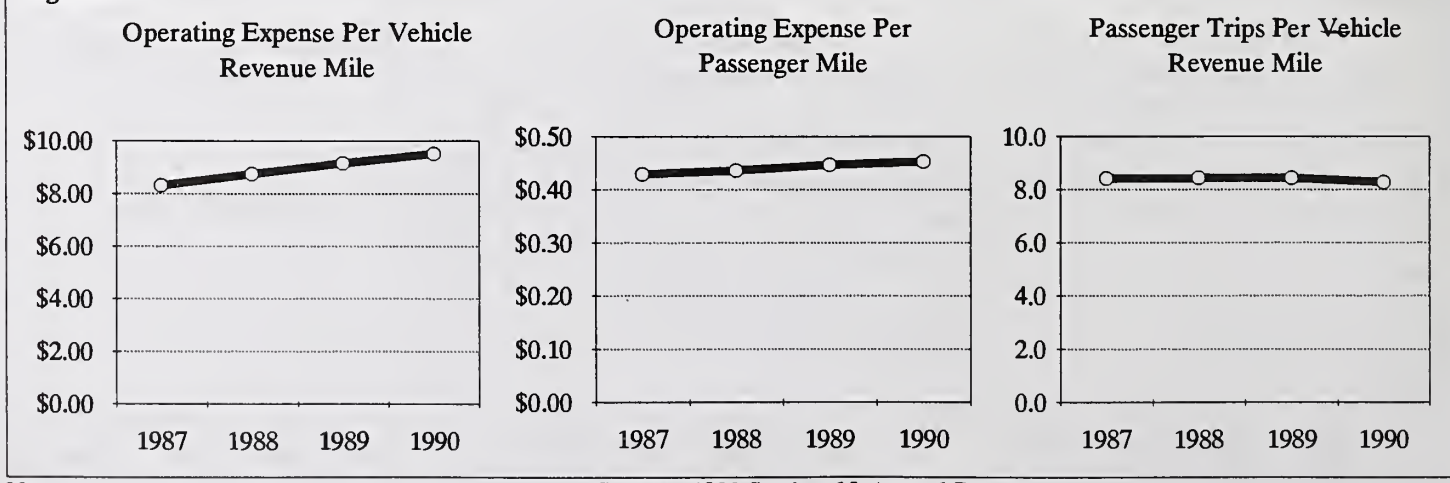
Exhibit 8 (continued) National Transit Profile by Mode

Characteristics	Commuter Rail	Light Rail
Operating Expense (millions)	2,156.8	344.6
Annual Unlinked Trips (millions)	328.4	299.7
Annual Passenger Miles (millions)	7,082.3	763.0
Average Weekday Unlinked Trips (millions)	1.0	1.0
Annual Vehicle Revenue Hours (millions)	6.0	3.5
Annual Vehicle Revenue Miles (millions)	193.1	36.3
Fixed Guideway Directional Route Miles	5,093.9	842.1
Total Fleet (Directly Operated Service)	4,578	1,650
Vehicles Operated in Maximum Service (Directly Operated Service)	3,922	1,144
Peak to Base Ratio	2.5	1.7
Spare Ratio (Directly Operated Service)	18%	56%
Performance Measures		
Service Efficiency		
Operating Expense/Vehicle Revenue Hour	$359.47	$98.46
Operating Expense/Vehicle Revenue Mile	$11.17	$9.49
Cost Effectiveness		
Operating Expense/Unlinked Passenger Trip	$6.57	$1.15
Operating Expense/Passenger Mile	$0.30	$0.45
Service Effectiveness		
Unlinked Passenger Trips/Vehicle Revenue Hour	54.7	85.6
Unlinked Passenger Trips/Vehicle Revenue Mile	1.7	8.3

Commuter Rail



Light Rail



Source: 1990 Section 15 Annual Report

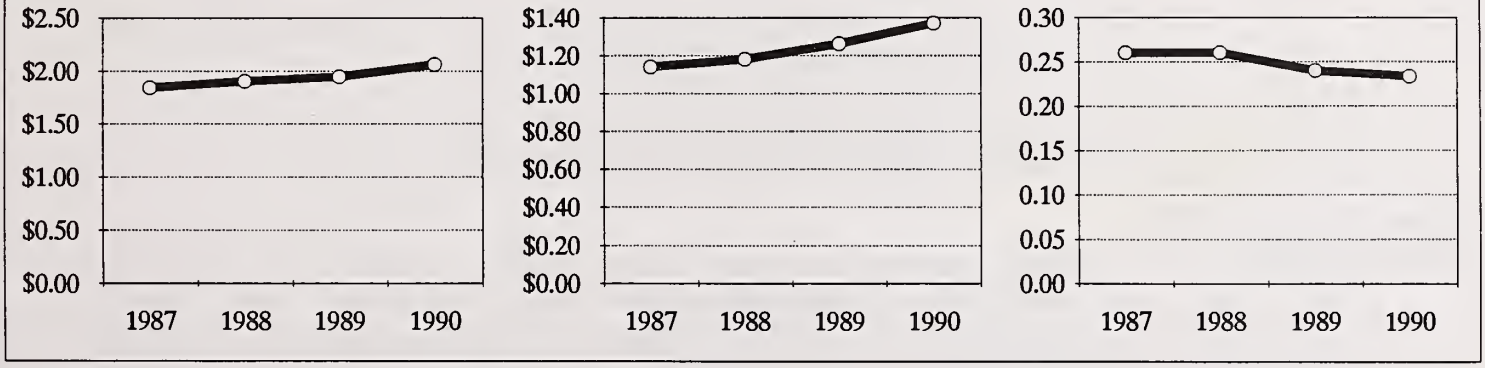
Exhibit 8 (continued) National Transit Profile by Mode

Characteristics	Demand Response
Operating Expense (millions)	385.5
Annual Unlinked Trips (millions)	39.7
Annual Passenger Miles (millions)	258.9
Average Weekday Unlinked Trips (millions)	0.1
Annual Vehicle Revenue Hours (millions)	12.3
Annual Vehicle Revenue Miles (millions)	171.2
Fixed Guideway Directional Route Miles	N/A
Total Fleet (Directly Operated Service)	3,303
Vehicles Operated in Maximum Service (Directly Operated Service)	2,627
Peak to Base Ratio	1.1
Spare Ratio (Directly Operated Service)	28%

Performance Measures

Service Efficiency	
Operating Expense/Vehicle Revenue Hour	$31.66
Operating Expense/Vehicle Revenue Mile	$2.27
Cost Effectiveness	
Operating Expense/Unlinked Passenger Trip	$9.69
Operating Expense/Passenger Mile	$1.50
Service Effectiveness	
Unlinked Passenger Trips/Vehicle Revenue Hour	3.3
Unlinked Passenger Trips/Vehicle Revenue Mile	0.2

Demand Response



Source: 1990 Section 15 Annual Report

Performance Measures

The modes are very different with respect to average speed (see Chapter 3, Service Supplied), average passenger trip length (see Chapter 2, Service Consumption), cost of operation (see Chapter 4, Operating Expenses), and carrying capacity.

These distinctions lead to major variations in the examples of performance measures discussed below:

Motor Bus, on average, is less costly than the rail modes based on service provided (service efficiency measures), but loses that advantage when passenger usage is considered (cost effectiveness measures).

Commuter Rail is more than twice the cost of Heavy Rail on a per vehicle hour basis, but almost identical with Heavy Rail in cost per passenger mile, and by far the most effective mode in terms of passenger miles per vehicle hour.

Demand Response service is the least expensive mode on a cost per vehicle hour basis, but by far the most expensive on a cost per passenger trip or cost per passenger mile basis.

Operating Expense per Vehicle Revenue Mile

Operating Expense per Vehicle Mile evaluates service efficiency. It compares service provided (vehicle revenue miles) to the total operating cost of providing service (operating expense). Chapter 4, Operating Expenses, provides additional service efficiency measures and extensive expense information.

Bus service cost per mile increased about 15 percent from 1987 to 1990, averaging about 4.5 percent per year, which is less than the increase in inflation.

Heavy Rail increased its unit cost by less than eight percent over the four years, with increases averaging about 2.5 percent per year.

Commuter Rail service cost per mile increased less than ten percent between 1987 and 1990, including a four percent change since 1989.

Operating Expense per Passenger Mile

Operating Expense per Passenger Mile evaluates cost effectiveness. It compares utilization of service (passenger miles) to the cost of providing service. Chapter 4, Operating Expenses, provides additional cost effectiveness measures and additional information.

Commuter Rail is the most effective mode in this context, at $.29 per passenger mile, followed closely by Heavy Rail, at $.33.

Demand Response service, the least expensive mode on a cost per vehicle mile basis, is the most expensive here, averaging $1.36 per passenger mile.

Increases over the four years ranged from five percent for Light Rail and Trolleybus, 15 percent for Bus and Heavy Rail, to 19 and 20 percent for Demand Response and Commuter Rail.

Passenger Trips per Vehicle Revenue Mile

Passenger Trips per Vehicle Revenue Mile visually demonstrates levels of boarding activity, and is a measure of service effectiveness. This indicates the match between service provided (miles) and service demanded or consumed (passenger trips). Chapter 2, Service Consumption, provides additional measures and additional information.

Bus service stayed constant at 3.2 trips per mile since 1987, indicating a constant fit of service provided to service consumed.

Heavy Rail demonstrated the highest value for this measure. Heavy Rail vehicles are designed to carry heavy passenger loads in congested corridors. Heavy Rail trips have fluctuated somewhat over time.

Commuter Rail vehicles normally have fewer boardings per mile than Heavy Rail, because there are fewer stops and passengers typically make longer trips. The trend in Commuter Rail boardings declined from 1.8 trips per hour in 1987 to 1.7 trips per hour in 1990.

Profile by Size of Bus Fleet

Exhibit 9 profiles the bus portion of the national transit industry in terms of size of bus fleet (vehicles operated in maximum service.)

Characteristics

Bus systems with fewer than 25 buses supplied seven percent of all bus revenue miles and five percent of all bus revenue hours. Passengers on small systems accounted for three percent of unlinked passenger trips and passenger miles on bus systems. The smallest systems required five percent of all bus operating expense.

Bus systems with 25 to 99 buses supplied 14 percent of all bus revenue miles and 13 percent of all bus revenue hours. Passengers on these systems accounted for eight percent of unlinked bus passenger trips and ten percent of bus passenger miles. The small systems required nine percent of all operating expense for bus systems.

Bus systems with 100 to 249 buses supplied 19 percent of all bus revenue miles and 18 percent of all bus revenue hours. Passengers on mid-sized systems accounted for 14 percent of unlinked bus passenger trips and 18 percent of bus passenger miles. The mid-sized systems required 15 percent of all operating expense for bus systems.

Bus systems with over 250 buses supplied 60 percent of all bus revenue miles and 64 percent of all bus revenue hours. Passengers on these systems consumed 75 percent of unlinked bus passenger trips and 69 percent of bus passenger miles. The largest systems required 71 percent of all operating expense for bus systems.

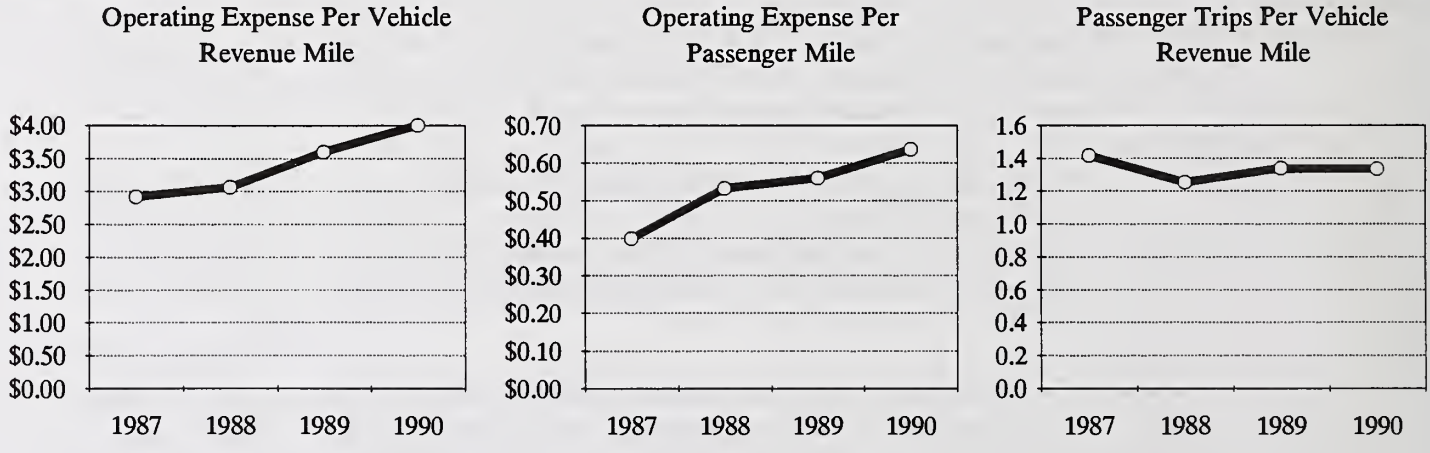
Performance Measures

Different sizes of bus systems vary with respect to average speed (see Chapter 3, Service Supplied), cost of operation (see Chapter 4, Operating Expenses) carrying

Exhibit 9 National Transit Profile By Size of Bus Fleet

Characteristics	Under 25	25 - 99
Operating Expense (millions)	353.8	734.3
Annual Unlinked Trips (millions)	138.3	415.1
Annual Passenger Miles (millions)	557.2	1830.4
Average Weekday Unlinked Trips (millions)	0.8	1.5
Annual Vehicle Revenue Hours (millions)	6.5	15.2
Annual Vehicle Revenue Miles (millions)	102.3	215.3
Fixed Guideway Directional Route Miles	25,355	39,179
Total Fleet (Directly Operated Service)	2,620	6,965
Vehicles Operated in Maximum Service (Directly Operated Service)	1,920	5,504
Peak to Base Ratio	1.5	1.5
Spare Ratio (Directly Operated Service)	77%	41%
Performance Measures		
Service Efficiency		
Operating Expense/Vehicle Revenue Hour	$54.40	$48.00
Operating Expense/Vehicle Revenue Mile	$3.46	$3.39
Cost Effectiveness		
Operating Expense/Unlinked Passenger Trip	$2.54	$1.76
Operating Expense/Passenger Mile	$0.63	$0.40
Service Effectiveness		
Unlinked Passenger Trips/Vehicle Revenue Hour	21.4	27.3
Unlinked Passenger Trips/Vehicle Revenue Mile	1.4	1.9

Under 25



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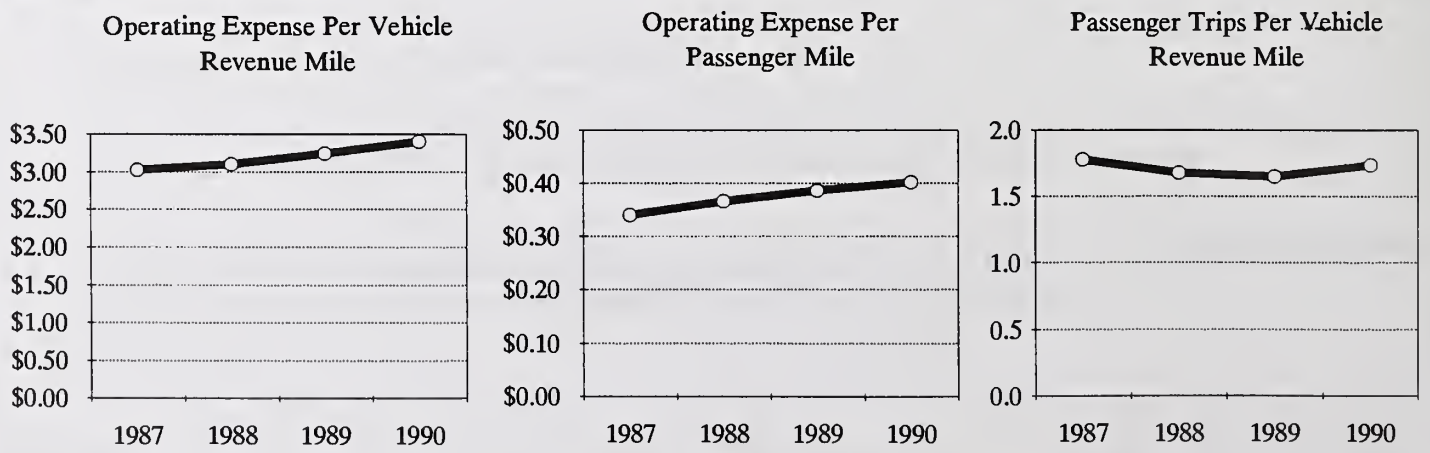
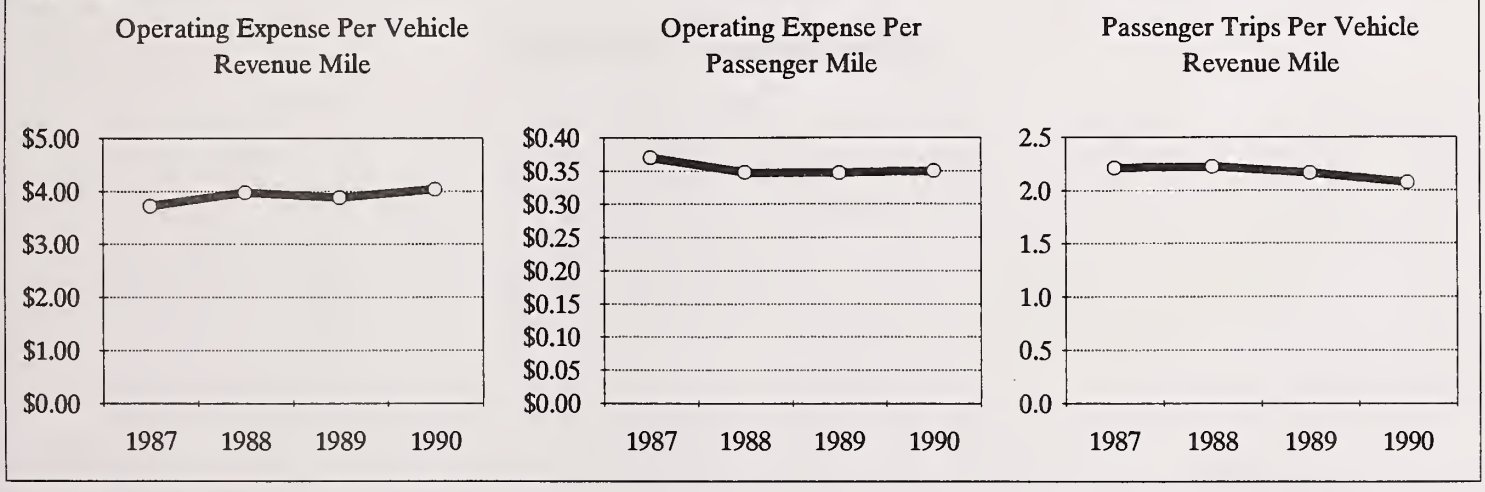


Source: 1990 Section 15 Annual Report

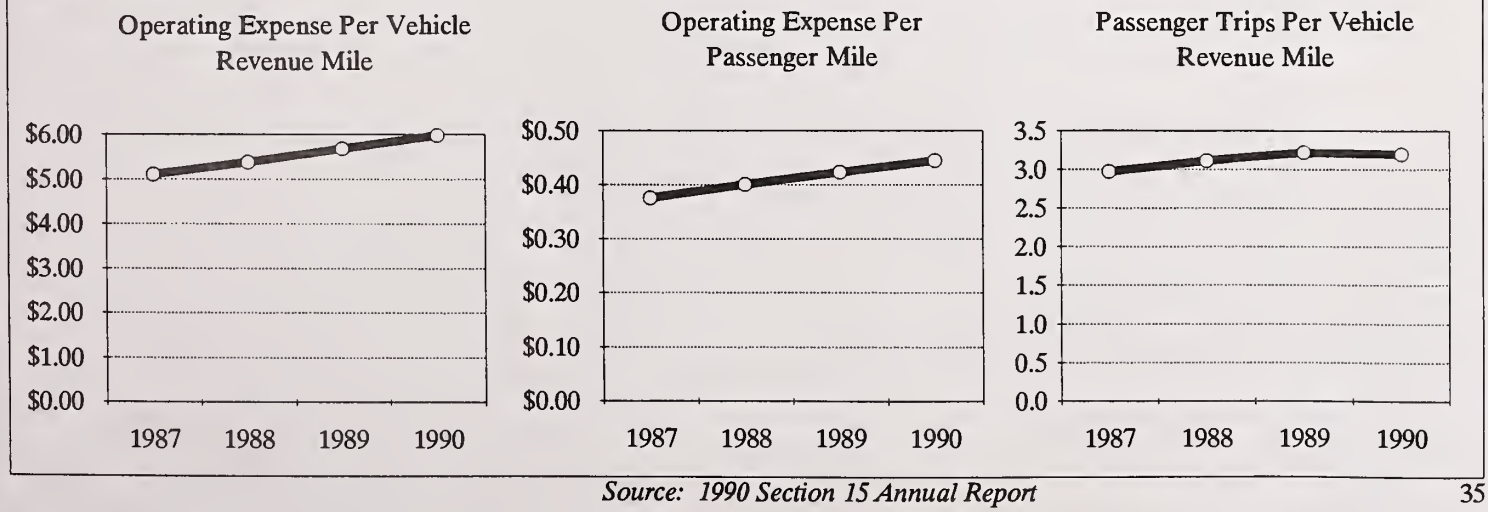
Exhibit 9 (continued) National Transit Profile by Size of Bus Fleet

Characteristics	100 - 249	250 and Over
Operating Expense (millions)	1,172.8	5,527.8
Annual Unlinked Trips (millions)	642.5	3,691.2
Annual Passenger Miles (millions)	3,218.7	12,463.3
Average Weekday Unlinked Trips (millions)	2.2	12.3
Annual Vehicle Revenue Hours (millions)	21.4	77.0
Annual Vehicle Revenue Miles (millions)	291.1	925.8
Fixed Guideway Directional Route Miles	37,448	70,366
Total Fleet (Directly Operated Service)	9,561	31,085
Vehicles Operated in Maximum Service (Directly Operated Service)	7,751	25,665
Peak to Base Ratio	1.8	1.9
Spare Ratio (Directly Operated Service)	45%	22%
Performance Measures		
Service Efficiency		
Operating Expense/Vehicle Revenue Hour	$54.80	$71.79
Operating Expense/Vehicle Revenue Mile	$4.03	$5.97
Cost Effectiveness		
Operating Expense/Unlinked Passenger Trip	$1.76	$1.50
Operating Expense/Passenger Mile	$0.35	$0.44
Service Effectiveness		
Unlinked Passenger Trips/Vehicle Revenue Hour	31.2	47.9
Unlinked Passenger Trips/Vehicle Revenue Mile	2.3	4.0

100 - 249



250 and Over



Source: 1990 Section 15 Annual Report

capacity, and average passenger trip length (see Chapter 2, Service Consumption). These differences lead to the variations in the examples of performance measures discussed below.

- The largest bus systems exhibited the highest expense per vehicle revenue hour and vehicle revenue mile, but achieved the lowest cost per unlinked passenger trip. This contrast in measures occurs because the largest systems had the highest rate of unlinked passenger trips per vehicle hour and vehicle mile: more than twice the level of the smallest systems.

- Bus systems with 100 to 249 buses experienced a lower average cost per hour and cost per mile than the largest systems: cost per hour was almost 24 percent less than the largest systems; cost per mile was 32 percent less. These systems had a longer average trip length than the largest systems (see Chapter 2, Service Consumption), so that while cost per passenger trip was higher than the large systems, cost per passenger mile was lower.

- Bus systems with 25 to 99 buses had the highest service efficiency, achieving the lowest average cost per hour and cost per mile. Cost effectiveness was very similar to systems with 100 to 249 buses, while service effectiveness was lower.

Chapter 2

Service Consumption

Introduction

Service consumed is the ultimate measure of the effectiveness of service provided to the public. Supplying service without carrying passengers would be a waste of valuable resources. Transit systems are engaged in a perpetual struggle to meet the needs of customers, balanced against the limits of funding. Transit systems must introduce new services to meet the changing needs of current and potential passengers, without neglecting established services that are often the key to mobility for patrons dependent on transit. At the same time, transit systems are frequently required to increase passenger fares, which invariably reduces the number of passengers using the service. In all but the most extreme cases, the new revenue from a fare increase exceeds the revenue lost from passenger attrition. However, the loss of passengers can never be taken lightly.

Chapter 3 discusses service supplied. Significant increases in service supplied took place from 1987 to 1990, indicating new services were being offered to attract passengers. Chapter 5 discusses the funding of service, including the fact that passenger fares increased steadily over the four year period. Passenger revenue per vehicle mile increased by almost seven percent; passenger revenue per unlinked passenger trip increased almost 12 percent.

Increasing service generally attracts new riders, while fare increases force some away. The confluence of these two forces (increasing service and increasing fares) is indicated in one of the performance measure discussed in this chapter, i.e., total passenger trips per vehicle mile. This measure decreased more than five percent during the four year period. Within this context, the modest national increase in passenger trips and passenger miles in this period may be viewed as no easy accomplishment.

Service Consumption Overview

The question of how much service is used is answered in terms of unlinked passenger trips and passenger miles. The number of trips and passenger miles is compared to the vehicle miles and hours supplied as service effectiveness indicators.

Chapter Organization

The review of Service Consumption is divided into four sections:

Service Consumption by Mode

Market shares and national trends for total Passenger Miles and Unlinked Passenger Trips are reviewed by Mode and by Type of Service (Directly Operated Service compared to Purchased Transportation Service). A series of performance measures and characteristics related to service consumption by mode are then introduced and discussed.

Service Consumption by Size of Bus Fleet

Exhibit 10 presents some basic data about this sub-set of the discussion by mode. Three performance measures and characteristics which were introduced in the modal review are also presented by size of bus fleet.

Service Consumption by UZA Size

The third section presents market shares and national trends of service consumption by UZA size. The trend analysis includes an evaluation of the impact of the 1990 Census on defining and analyzing ridership patterns by UZA size. Unlinked Passenger Trips per Vehicle Revenue Hour is the only performance measure trend reviewed. Reference is made to the base information on modes and size of bus fleet, as the mix of modes and system sizes significantly influences all facets of aggregate performance.

Service Consumption by Region

Two performance measure trends are discussed in this final section: Unlinked Passenger Trips per Vehicle Revenue Hour, and Passenger Miles by Vehicle Revenue Hour.

Section Description

Modes

The modes considered are Bus, Heavy Rail, Commuter Rail, Light Rail, and Demand Response. All other modes have been grouped into the category of Other. Performance measures are not evaluated for the Other category since the modes represented are dissimilar. Refer to the Introduction for more complete descriptions.

Size of Bus Fleet

Bus service is the largest mode in terms of number of systems represented (53 percent), passengers (62 percent), passenger miles (48 percent), and other criteria such as miles and hours of service supplied (as examined in the following chapter). Therefore, the Bus mode has been reviewed in greater detail based on system size. Bus systems have been grouped based on the number of vehicles required in maximum service: fewer than 25 buses, 25 to 99 buses, 100 to 249 buses, and over 250 buses.

Performance Measures by Mode and Size of Bus Fleet

Modes and sizes of bus systems are compared through average trip length (passenger miles divided by unlinked passenger trips), average load factor (passenger miles divided by vehicle revenue miles), and trends in passenger boardings per hour of service (unlinked passenger trips divided by vehicle revenue service hours). Trends in unlinked passenger trips per vehicle revenue mile are also discussed by mode.

- Average trip length is greatly influenced by the transfer patterns in a given system as well as by general trip purpose. This measure vividly shows the differences in the types of trips among the various modes.

- Average load factor measures the combination of trip length, vehicle capacity, and patterns of travel. Bus, for example, blends high and low density travel,

providing service to outlying areas and service late at night to provide mobility to a widespread population. Commuter Rail, in contrast, serves high density corridors with limited stops.

- Boardings per hour or per mile display the boarding and alighting characteristics of the various modes and sizes of bus systems.

Size of Urbanized Area

Selected service factors and trends are examined based on the size of the urbanized area. Urbanized areas are chiefly distinguished by varying densities, which both determine and are determined by the metropolitan choices of transportation modes. As urbanized areas increase in size, higher capacity modes are developed to transport people. High capacity modes are generally based on rail technology. Heavy Rail is exclusively found in urbanized areas with over one million population. A full 4,111 out of 4,121 commuter rail vehicles serve urbanized areas with over one million population, and 95 percent of all light rail vehicles serve the largest urbanized areas. An increase in rail has not been the only response to congestion problems. Some urbanized areas have developed extensive networks of separate busways, which provide the commuter with the speed advantages of rail. Therefore, much of the discussion of service provided by size of urbanized area will refer to the information established during the discussions of modes and bus system sizes, as the mix of modes is often the key determinant of performance measures for an urbanized area.

Performance Measures by Size of Urbanized Area

Urbanized areas are compared through total amounts of service consumed and through the performance measure of unlinked passenger trips per vehicle revenue hour. The volume of service suggests the scale of operations in large urbanized areas versus small urbanized areas. Unlinked passenger trips per hour compares urbanized areas on a common denominator of service hours, and shows the varying levels of intensity of transit use. This intensity is influenced by population density and by the modes employed.

Regions

The factors of geography, climate, and particularly the impact of historical urban development patterns vary by region. Trends in two performance measures are presented, providing a glimpse of the effects on transit.

Performance Measures by Region

Regions are compared through boardings per hour and passenger miles per hour. These measures suggest the different stages and intensities of urbanization in various parts of the country.

Additional Information

Definitions of Unlinked Passenger Trips and Passenger Miles

Please note that an unlinked passenger trip is defined as each time a passenger boards a public transportation vehicle. It is not a count of a passenger's journey from origin to destination (or linked trip). For example, a passenger transferring from one bus to another for a single journey, or from bus to rail, counts as two unlinked passenger trips. This definition may lead to an underestimation of rail trips compared with bus trips if transfers between rail services (such as from one rail line to another) are not counted. In this respect, passenger mile information, which measures the total distance traveled by transit passengers, is comparable between modes, because the transfer factor is not relevant in the computation.

Related Measures

Certain cost effectiveness measures, such as operating expense per unlinked passenger trip and per passenger mile, are examined in Chapter 4 in connection with the discussion of Operating Expenses.

Other cost effectiveness measures, such as the ratio of passenger operating revenue to operating expense, are discussed in Chapter 5 within the context of operating and capital funding (by size of urbanized area and by region).

Service Consumption by Mode

In 1990, transit ridership was about eight billion unlinked passenger trips. This equates to an average of 32 trips per person nationwide. These passengers traveled about 38 billion passenger miles, or roughly 151 miles per person.

Exhibit 10, Service Consumed by Mode, is a table of highlights of the data and graphs that follow. Bus provides the greatest volume of passenger service. The modes exhibit significant differences in passenger service characteristics such as passenger trip length, the average number of passengers on board a vehicle (load factor), and the average number of passengers boarding the vehicle each hour. These differences are related to the general purpose the mode was designed to fulfill, which then dictates vehicle capacity, service design (the number of stops, for example), and other operating characteristics.

Exhibit 10

Overview: Service Consumption by Mode
1990

Mode	Measures				
	Unlinked Passenger Trips (millions)	Passenger Miles (millions)	Average Trip Length (miles)	Average Load Factor	Unlinked Passenger Trips per Vehicle Revenue Hour
Bus	4,887	18,070	3.7	12	41
Heavy Rail	2,346	11,475	4.9	22	89
Commuter Rail	328	7,082	21.6	37	54
Light Rail	300	763	2.5	21	86
Demand Response	40	259	6.5	2	3
Other	64	342	N/A	N/A	N/A
Weighted Average	-	-	4.8	15	47
Total	7,966	37,991	-	-	-

Note: Slight deviations in totals may occur due to rounding.

Market Share By Mode

Exhibit 11, Distribution of Unlinked Passenger Trips by Mode, and Exhibit 12, Distribution of Passenger Miles by Mode, display the respective transit market shares for each mode.

- Bus served the highest share, over 61 percent of total unlinked passenger trips. Bus was responsible for nearly 48 percent of total passenger miles. As will be discussed in the following chapter, Bus supplied about 62 percent of all vehicle miles.

Exhibit 11

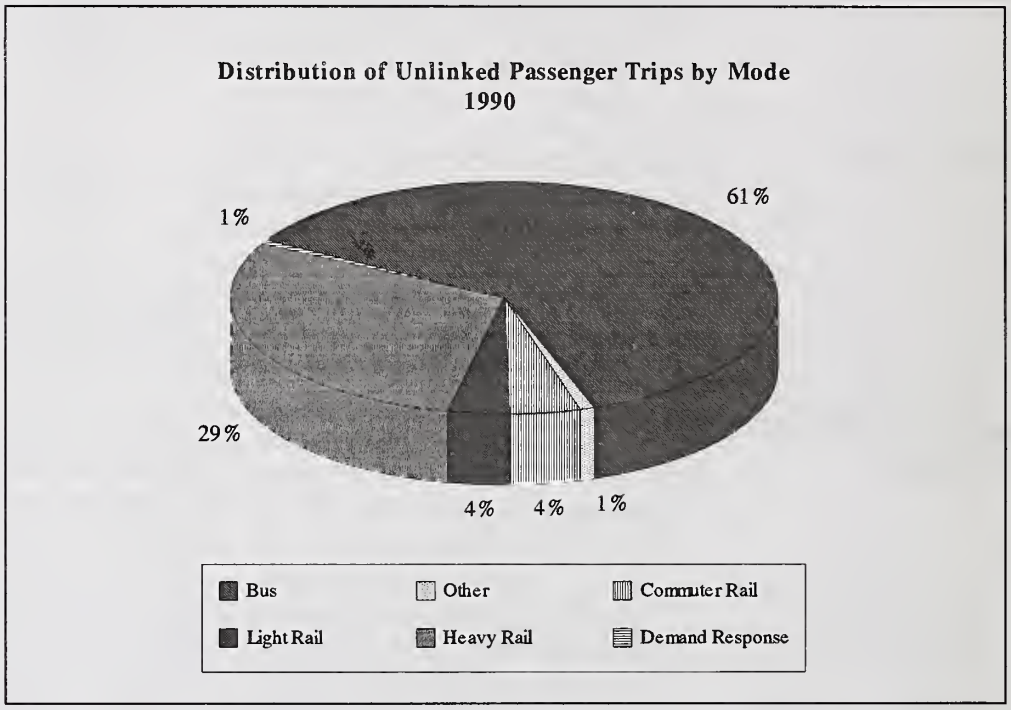
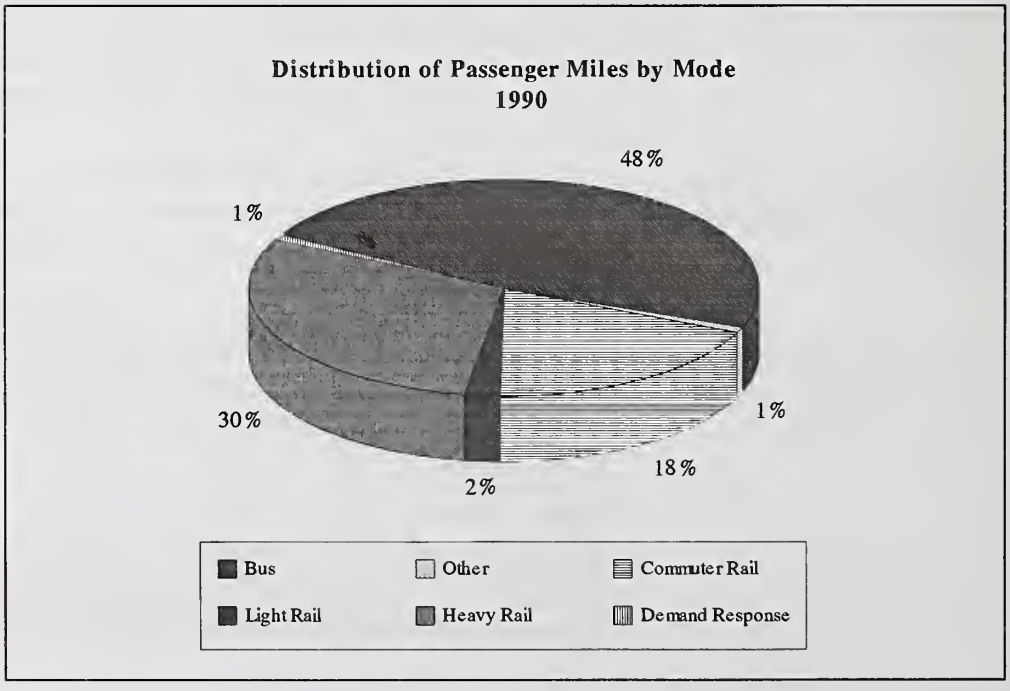


Exhibit 12



- Heavy Rail served the next greatest number of unlinked passenger trips and passenger miles at 29 and 30 percent respectively. Heavy Rail supplied about 21 percent of total vehicle miles.

- Commuter Rail served only about four percent of passenger trips, but provided almost 19 percent of all passenger miles. The average trip length for Commuter Rail was almost 22 miles, or about five times the average trip length of Heavy Rail trips.

- Commuter Rail supplied about eight percent of vehicle miles.

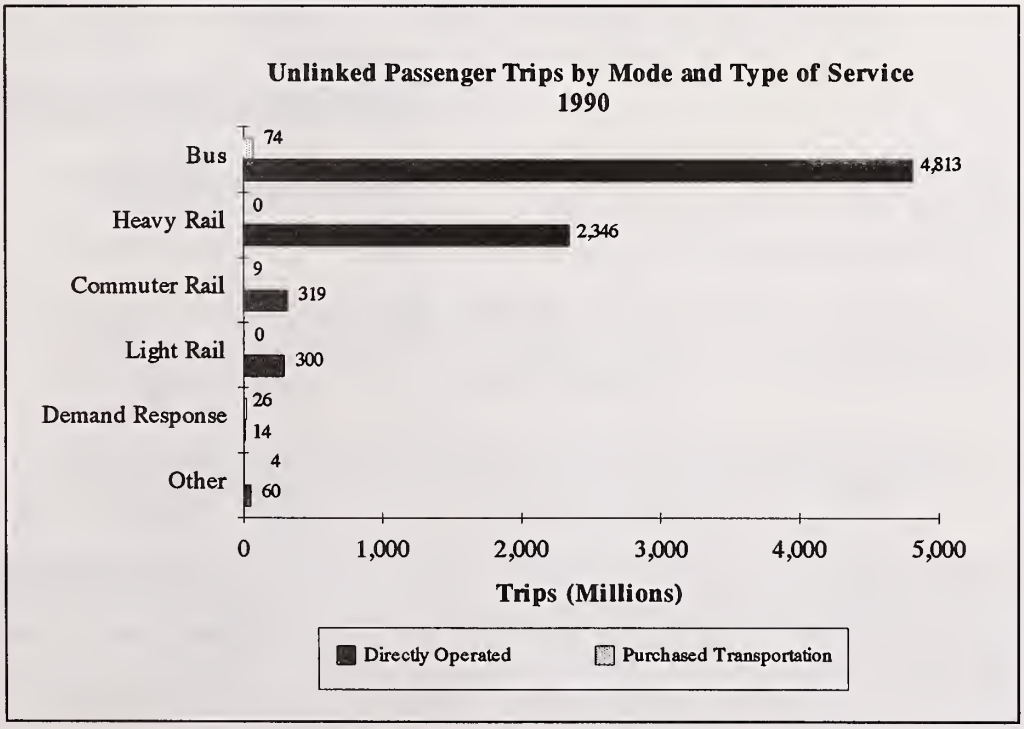
- Light Rail was responsible for almost four percent of the passengers, and about two percent of the passenger miles. Light Rail supplied about 1.5 percent of all vehicle miles.

- Demand Response was responsible for 0.5 percent of all passenger trips, and 0.7 percent of passenger miles. As will be discussed in the following chapter, Demand Response supplied about seven percent of vehicle miles.

Unlinked Passenger Trips by Mode and Type of Service

Exhibits 13, 14, 15, and 16 provide additional perspective on passenger trips and passenger miles by mode. Exhibit 13 displays the amount of passenger trips on Directly Operated service, relative to trips on Purchased Transportation. Exhibit 14 displays the four-year trend of unlinked passenger trips by mode. Exhibits 15 and 16 are tables of trend information by mode and type of service for passenger trips and passenger miles, respectively.

Exhibit 13



- Directly Operated service was responsible for most passengers and passenger miles. Purchased Transportation service provided 1.4 percent of all unlinked passenger trips and 2.6 percent of all passenger miles. The role played by Purchased Transportation varied by mode. It was particularly significant for Demand Response service, and played no role in providing Light and Heavy Rail service.

- Approximately 1.5 percent of all Bus trips and three percent of all Bus passenger miles were made on Purchased Transportation service. Although this signifies a small proportion of service, the increase from 1987 levels exceeded 54 percent.

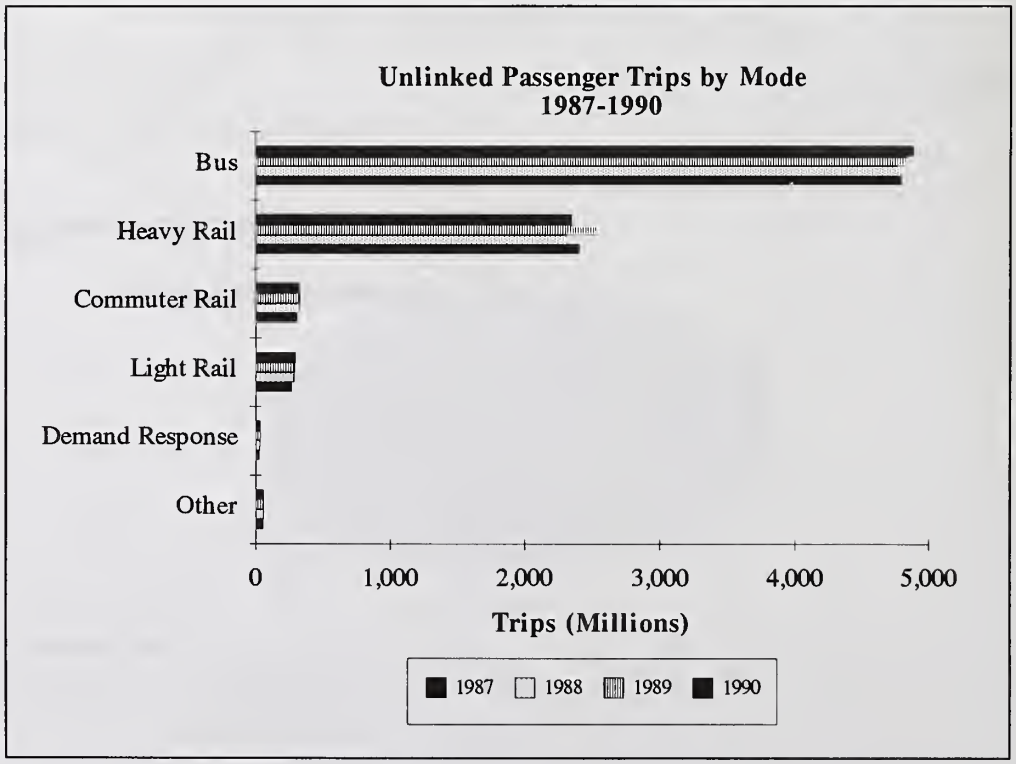
- Approximately three percent of Commuter Rail unlinked passenger trips and four percent of Commuter Rail passenger miles were supplied by Purchased Transportation.

- Approximately 65 percent of all Demand Response passenger trips and 57 percent of all passenger miles were supplied by Purchased Transportation. Total passengers on Demand Response service increased by 38 percent from 1987 to 1990. Passenger trips using Purchased Transportation services increased by 30 percent over the same period.

Unlinked Passenger Trips by Mode

Ridership remained essentially constant during the four year period, increasing only 1.3 percent. 1990 unlinked trips totaled 8.0 billion (See Exhibit 14). This compares to 7.9 billion in 1987, 7.8 billion in 1988, and 8.1 billion in 1989. However, ridership trends by mode varied significantly.

Exhibit 14



- Bus ridership increased to 4.9 billion trips in 1990, which represents an increase of 118 million trips, or 2.5 percent since 1987. This also represents an additional 75 million trips, or 1.6 percent since 1989.

Exhibit 15

Unlinked Passenger Trips by Mode and Type of Service
(millions)
1987-1990

Mode/Type of Service	Years			
	1987	1988	1989	1990
Bus				
Directly Operated	4,748	4,747	4,780	4,813
Purchased Transportation	48	47	58	74
Total	4,796	4,794	4,838	4,887
Heavy Rail				
Directly Operated	2,402	2,308	2,542	2,346
Purchased Transportation	0	0	0	0
Total	2,402	2,308	2,542	2,346
Commuter Rail				
Directly Operated	302	314	319	319
Purchased Transportation	9	11	10	9
Total	311	325	330	328
Light Rail				
Directly Operated	272	289	291	300
Purchased Transportation	0	0	0	0
Total	272	289	291	300
Demand Response				
Directly Operated	10	11	13	14
Purchased Transportation	20	23	24	26
Total	30	34	37	40
Other				
Directly Operated	54	61	59	60
Purchased Transportation	2	2	2	4
Total	56	63	61	64
Total Directly Operated	7,787	7,729	8,004	7,853
Total Purchased Transportation	79	83	95	112
Total	7,866	7,812	8,099	7,966

Note: Slight deviations in totals may occur due to rounding.

- Heavy Rail did not exhibit a steady trend or pattern of ridership. Ridership was 2.4 billion in 1987, 2.3 billion in 1988, and 2.5 billion in 1989, declining to 2.35 billion in 1990. The decrease from 1987 to 1990 is about two percent.

- Commuter Rail has grown to accommodate 328 million riders. This is a 5.6 percent increase from the 311 million riders in 1987, or an average increase of less than two percent per year.

- Light Rail increased to almost 300 million riders. This represents a ten percent increase from 1987 to 1990, an average of about 3.25 percent per year.

- Demand Response service experienced the most dramatic growth in passengers carried. Almost 40 million trips were made in 1990. This represents an increase of 38 percent from 1987, averaging over 11 percent per year. Demand Response trips still account for only 0.5 percent of total transit ridership, but are becoming more significant. Demand Response is the most

costly mode in terms of operating expense per unlinked passenger trip and operating expense per passenger mile (reviewed in Chapter 4, Operating Expenses). Trends of rapid growth are likely to continue as transit agencies begin to comply with the requirements of the Americans with Disabilities Act.

Exhibit 16

Passenger Miles by Mode and Type of Service
(millions)
1987-1990

Mode/Type of Service	Years			
	1987	1988	1989	1990
Bus				
Directly Operated	17,194	17,912	17,651	17,555
Purchased Transportation	284	270	359	515
Total	17,478	18,182	18,009	18,070
Heavy Rail				
Directly Operated	11,198	11,300	12,030	11,475
Purchased Transportation	0	0	0	0
Total	11,198	11,300	12,030	11,475
Commuter Rail				
Directly Operated	6,540	6,649	6,904	6,802
Purchased Transportation	266	315	308	281
Total	6,806	6,964	7,212	7,082
Light Rail				
Directly Operated	627	687	707	763
Purchased Transportation	0	0	0	0
Total	627	687	707	763
Demand Response				
Directly Operated	72	79	100	112
Purchased Transportation	107	131	133	147
Total	178	209	234	259
Other				
Directly Operated	300	359	329	313
Purchased Transportation	15	20	13	28
Total	315	379	342	342
Total Directly Operated	35,931	36,986	37,720	37,020
Total Purchased Transportation	672	735	813	970
Total	36,602	37,720	38,534	37,991

Note: Slight deviations in totals may occur due to rounding.

Performance Indicators

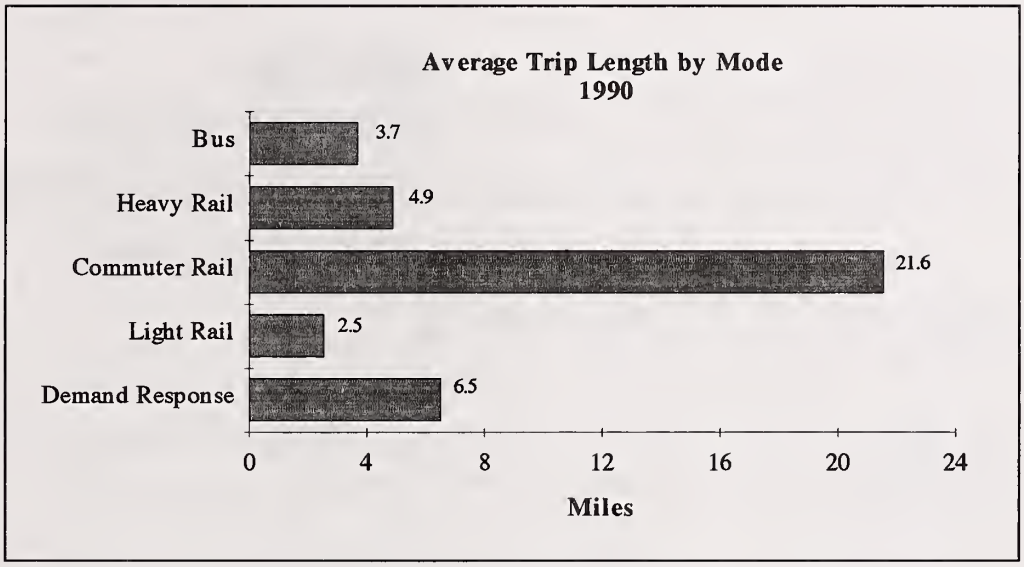
Service Characteristic: Average Trip Length by Mode

Average Trip Length by Mode (Exhibit 17) compares passenger miles to unlinked passenger trips. Average trip length is greatly influenced by the transfer patterns in a given system, as well as by the general trip purpose. It demonstrates the major differences in trip types among the various modes.

Combining all modes yields a 1990 average trip length of 4.77 miles. This is almost a three percent increase over the 1987 average of 4.65 miles. All modes have increased in average trip length, except for Commuter Rail.

- Bus trips, as noted above, are not completely comparable to other modes, since transfers count as multiple trips. With this in mind, the average bus trip was 3.7 miles. In 1987, the average was 3.6; the 1990 level represents an increase of 1.6 percent. The average trip length for Directly Operated service increased less than one percent, changing from 3.62 miles per trip in 1987 to 3.64 miles per trip in 1990. Purchased Transportation, however, experienced a 19 percent increase in average trip length, from 5.9 miles in 1987 to seven miles per trip in 1990.

Exhibit 17



- Heavy Rail trips were second in length to Commuter Rail, averaging 4.9 miles per trip. Average trip length on Heavy Rail increased by five percent from the 1987 level of 4.7 miles per trip.

- Commuter Rail patrons made the longest trips, averaging 21.6 miles per trip in 1990. Thus, while serving only 4.1 percent of total transit passenger trips, Commuter Rail accounts for 18.6 percent of total passenger miles. Average trip length declined 1.4 percent, from 21.9 miles per trip in 1987 to 21.6 passenger miles per unlinked passenger trip in 1990.

- Light Rail trips were the shortest of all major modes, averaging 2.5 miles. However, this figure represents a ten percent increase over the 1987 average of 2.3 miles. New Light Rail segments provided more suburban outreach than the traditional streetcar systems.

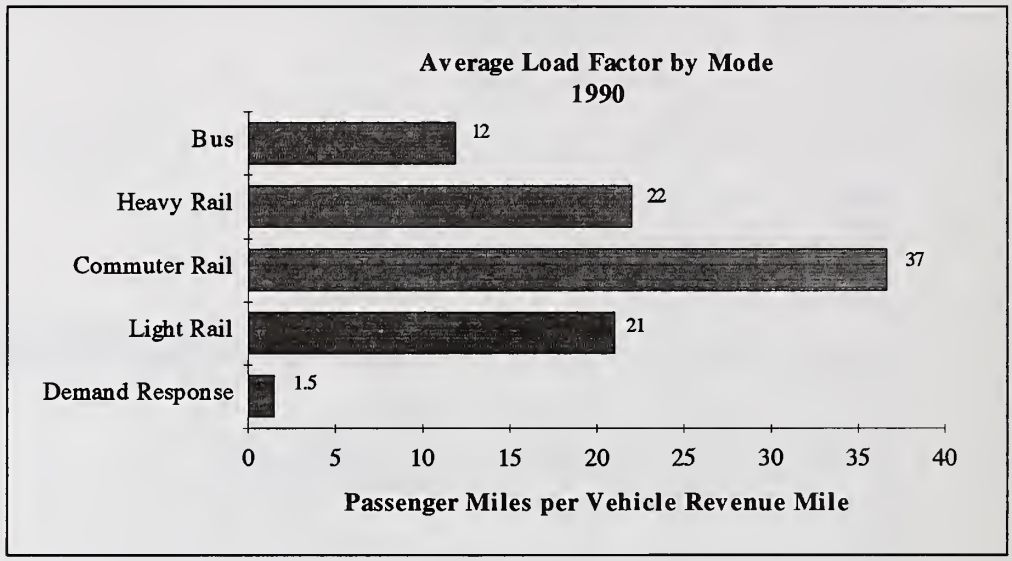
- Demand Response service averaged 6.5 miles per trip. This represents an increase of five percent over the 1987 average of 6.1 miles.

Service Efficiency: Average Load Factor by Mode

The average load factor (Exhibit 18) compares total passenger miles to total vehicle revenue miles. This is not a measure of capacity, although vehicle capacity is definitely an influence. It simply says that approximately X number of people are

on board the vehicle over the entire length of a route. It averages the generally small passenger loads at the end of the line or the middle of the night with the heavy loads generally experienced in the downtown areas and during peak periods. The comparison between modes provides additional perspective on the differences in the types of service.

Exhibit 18



Average load factor is influenced by the combination of trip length, vehicle capacity, and patterns of travel. Modes such as Bus blend high and low density travel, providing service to outlying areas and service late at night to provide mobility to a widespread population. Commuter Rail serves high density corridors with limited stops.

- Bus had an average load factor of almost 12.
- Heavy Rail averaged 22 passengers on board for each mile supplied.
- Commuter Rail averaged almost 37 passenger miles for every revenue mile.
- Light Rail had an average load factor of 21.
- Demand Response averaged 1.5 passengers on board for every vehicle revenue mile.

Service Effectiveness: Unlinked Passenger Trips per Vehicle Revenue Hour by Mode

Unlinked passenger trips per vehicle revenue hour (Exhibit 19) represents the boarding activity for each mode, and is a measure of intensity of use. It is not directly related to trip length. It moderately correlates to the speed of the vehicle,

since high numbers of boardings will tend to lower the miles per hour (depending also on the number of stops made). It also relates to levels of transfer activity, since high numbers of transfers increase the number of boardings. Across all modes, this measure remained steady since 1988, though this represents a decline from 1987.

- Bus remained stable, but with a slight decline in three out of four years since 1987. (The 1988 value dropped to 38.) 1990 trips per hour were 2.3 percent lower than 1987, at roughly 41 trips per hour.

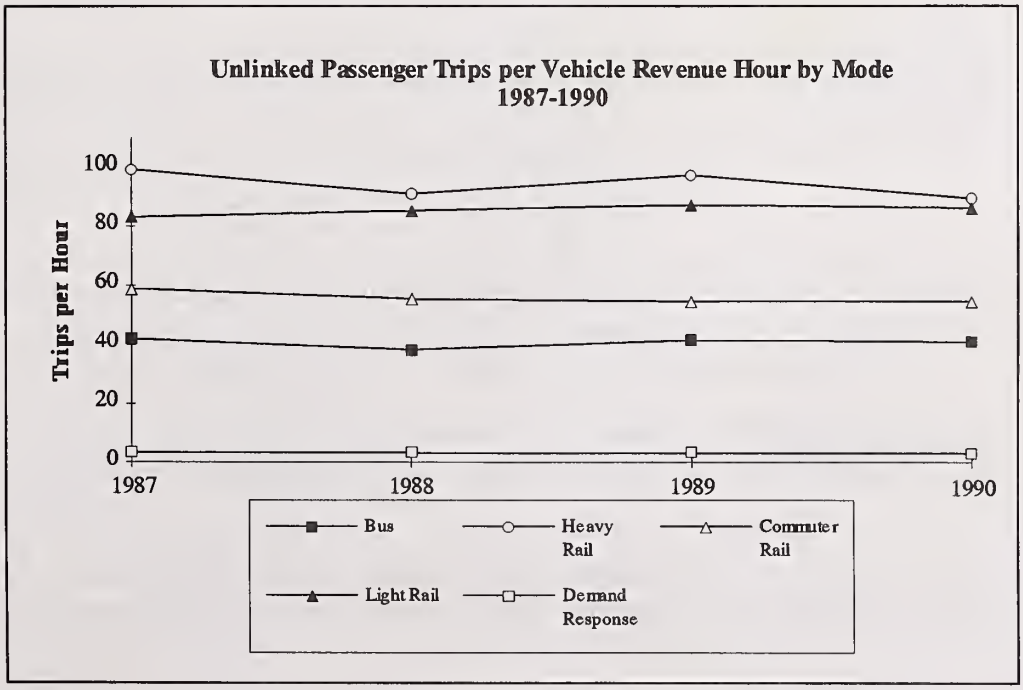
- Heavy Rail experienced fluctuations, as service levels varied more than the passengers. Chapter 3, Service Supplied, describes the significant service increases in this mode over the four year period. From 1987 to 1990, the values for boardings per passenger hour were 99, 91, 97, and 89 respectively. The difference between 1987 and 1990 is a decline of almost ten percent. The change from 1988 to 1990 is a decline of two percent.

- Commuter Rail maintained consistency for 1988, 1989, and 1990, averaging between 54 and 55 boardings per hour. The 1987 average was 59 boardings per hour; 1990 represents a decline of 7.5 percent from that level.

- Light Rail averaged between 85 and 87 boardings per hour since 1988. The 1990 average is an increase of 3.5 percent from the 1987 average of 83 boardings per hour.

- Demand Response declined ten percent in productivity over the four years, dropping from 3.5 to 3.1 boardings per hour. Over the four years, vehicle revenue hours increased by 52 percent. Unlinked passenger trips increased 38 percent. Whenever service supplied increases faster than service consumed, this measure will decline.

Exhibit 19



Service Effectiveness: Unlinked Passenger Trips per Vehicle Revenue Mile by Mode

Unlinked passenger trips per vehicle revenue mile represents the boarding activity for each mode (Exhibit 20). The contrast by mode between boardings per hour and boardings per mile directly reflects the average speed of each mode. Across all modes, this measure remained steady from 1988 to 1990. However, there was a five percent decline from 1987 levels. Fare increases tend to reduce the number of passengers, while service increases attract passengers. These changes did not occur on a one-for-one basis. Both forces were experienced by transit systems during the four year period; this performance measure is an indicator of the result.

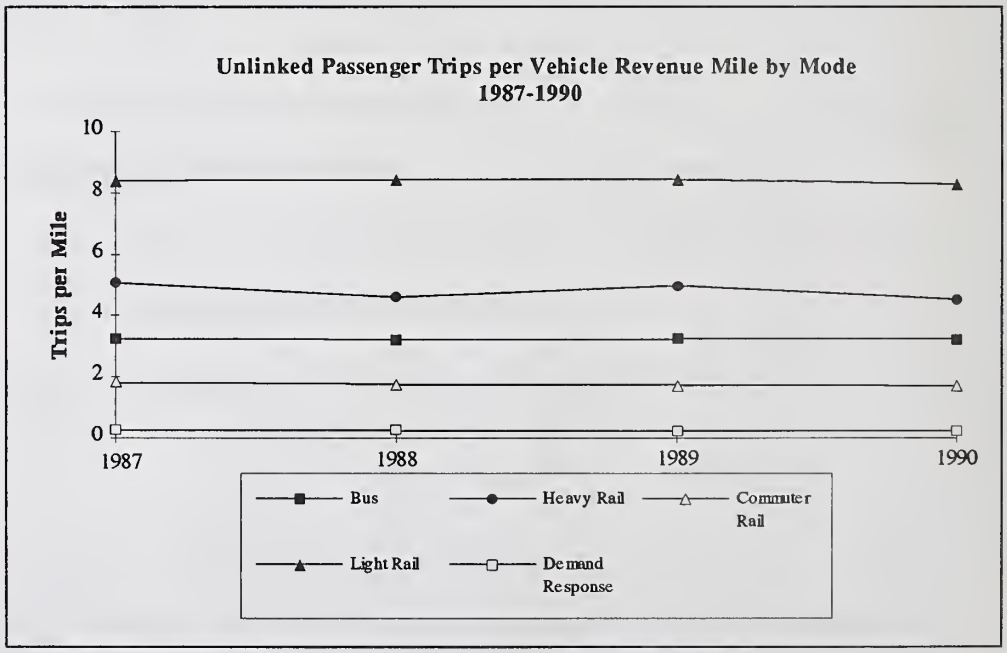
- Bus stayed almost constant at 3.2 passengers per vehicle revenue mile over the four years, with a decrease of one percent in this measure. Increases or decreases in passenger demands can be accommodated with corresponding changes in service; increases or decreases in service usually result in corresponding ridership changes.

- Heavy Rail unlinked passenger trips per mile fluctuated consistent with the passenger trips per hour. The decline from 1987 to 1990 is 11 percent.

- Commuter Rail averaged 1.7 boardings per mile. This represents a slight but continuing decline each year, from a level of 1.8 in 1987. The net change is a decrease of seven percent.

- Light Rail averaged between 8.4 and 8.3 passenger trips per vehicle revenue mile since 1987. The net decrease since 1987 is less than two percent.

Exhibit 20



- Demand Response averaged over 0.2 passenger trips per mile. In 1987, the average was less than 0.3. This represents a decline of about 11 percent, or an average annual decline in service effectiveness of approximately 3.7 percent per year.

Service Consumption by Size of Bus Fleet

Exhibit 21 previews the graphs to follow. Large systems, with 250 or more buses, provided about 75 percent of all the country's unlinked passenger trips made by public bus. They provided about 69 percent of all the passenger miles traveled on bus. Load factors and passenger trips per hour increase significantly with the increase in the size of bus system.

Exhibit 21

Overview: Service Consumption by Size of Bus Fleet

Number of Buses	Measures				
	Unlinked Passenger Trips (millions)	Passenger Miles (millions)	Average Trip Length (miles)	Average Load Factor	Unlinked Passenger Trips per Vehicle Revenue Hour
Under 25	138.3	557.2	4.1	5.5	22.4
25-99	415.1	1,830.4	4.5	8.5	27.5
100-249	642.5	3,218.7	5.0	11.4	30.1
250 and Over	3,691.2	12,463.3	3.4	13.5	47.9
Wieghted Average	-	-	3.7	11.8	40.7
Total	4,887.1	18,069.5	-	-	-

Note: Slight deviations in totals may occur due to rounding.

Performance Indicators

Service Effectiveness: Unlinked Passenger Trips per Vehicle Revenue Hour by Size of Bus Fleet

Large bus systems are more productive than small systems when comparing passenger boardings (unlinked passenger trips) per hour. Some performance evaluations emphasize passenger boardings per mile, which puts slower systems at a disadvantage. Systems that face significant urban congestion thus may prefer evaluations that include passengers per hour (See Exhibit 22).

- Systems with fewer than 25 buses averaged 22 passenger boardings per hour, or less than half the rate of the largest systems. The 1990 value is the highest of the four years, increasing from 20 and 21 trips per hour in 1988 and 1989 respectively. The 1990 figure is almost four percent higher than 1987.

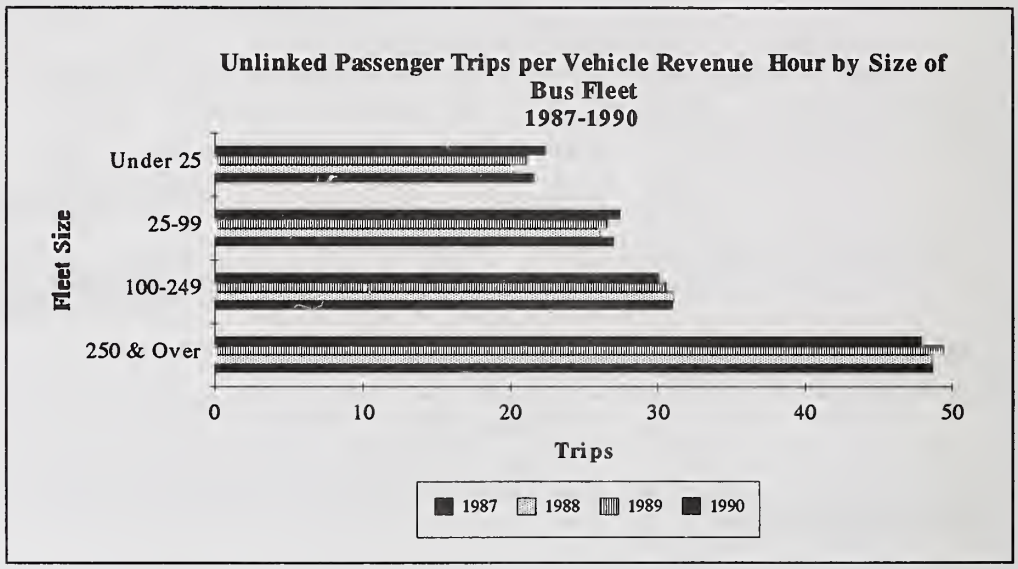
- Systems with 25 to 99 buses averaged 27 passenger boardings per hour. This value represents a two percent increase from the passengers per hour reported in 1987.

- Systems with 100 to 249 buses averaged 30 passenger boardings per hour. This represents a three percent decline from the 31 passengers per hour reported in 1987.

- Systems with more than 250 buses averaged 48 passenger boardings per hour. This represents less than a two percent decline from the 49 passengers per hour reported in 1987, 1988, and 1989.

The measure of unlinked passenger trips per hour for Bus across all sizes of systems was very stable, with slight annual fluctuations in the figures. This suggests that, on average, bus systems adjust bus service levels to meet passenger demands, and passenger levels adapt to available bus service levels.

Exhibit 22



Service Characteristic: Average Trip Length by Size of Bus Fleet

Average trip length compares passenger miles to unlinked passenger trips (Exhibit 23). It is influenced by urban geography, route structures and service design. The smallest and largest bus systems have the shortest passenger trip lengths. Average trip length is influenced by high levels of transfer activity, which increase passenger boardings. Many small systems operate a pulse type of service, where all buses circulating through various parts of the city meet at a central location on a regular schedule to allow transfers. Larger systems build intersecting routes with frequent service to maximize service area coverage.

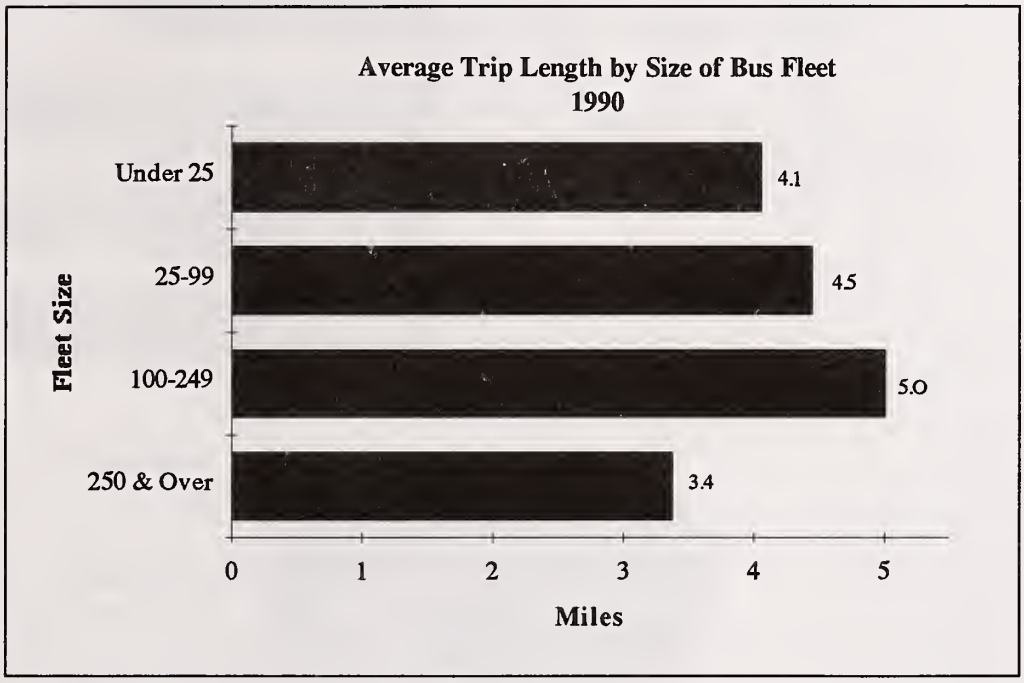
- Average trip length is also influenced by the type of service provided. For example, while the Bus mode as a whole has an average trip length of 3.7 miles, the average trip length for purchased service is seven miles, due to the commuter orientation of most purchased service.

- Average trip length was about 4.1 miles for bus systems with fewer than 25 vehicles. Systems between 25 and 99 buses averaged 4.5 miles per passenger trip.

- Systems between 100 and 250 buses averaged 5.0 miles per passenger trip.

- Systems of 250 or more buses averaged 3.4 miles per trip. This reflects the higher levels of transfer activity and on-off activity (boardings and exits) generally found in larger systems.

Exhibit 23

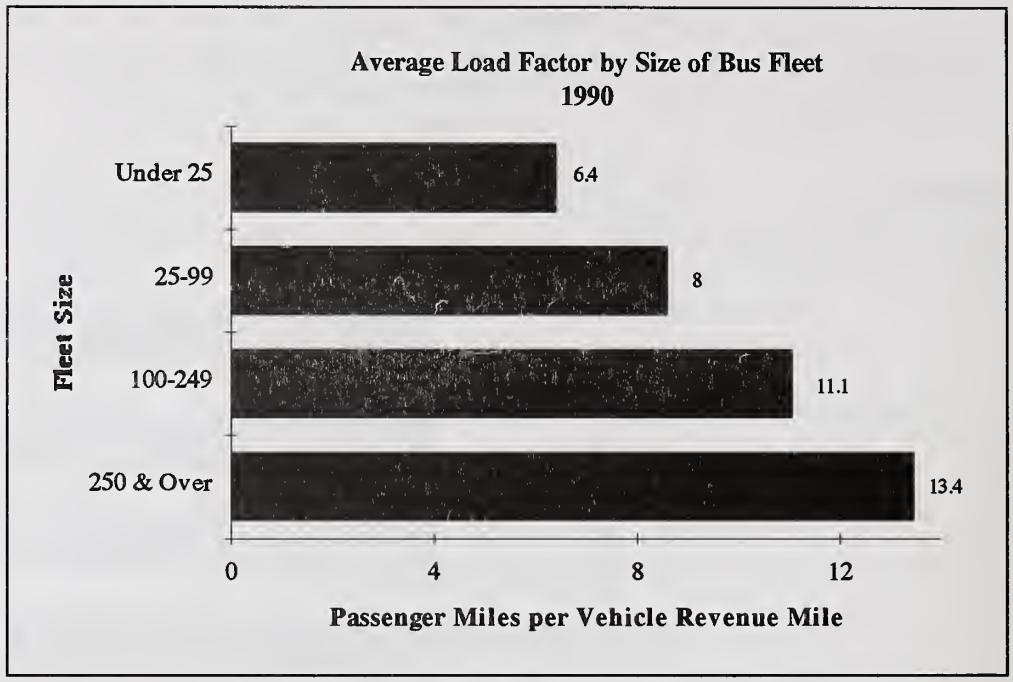


Service Efficiency: Average Load Factor by Size of Bus Fleet

Average load factor compares passenger miles consumed to vehicle revenue miles supplied (Exhibit 24). The measure reflects vehicle capacity and service density. The average load factor by size of bus fleet more than doubles from the smallest to the largest systems. Small systems are more likely to have smaller capacity buses, with 25 to 30 seats, while larger systems have many more large buses, seating 45 to 50. Larger systems may also operate articulated buses, with a seating capacity of around 70.

- Small systems (under 25 vehicles) had an average load factor of 6.4 passengers.
- Systems with 25 to 99 buses had an average load factor of 8.6 passengers.
- Systems with 100 to 249 buses had an average load factor of 11.1 passengers.
- Systems of 250 or more buses had an average load factor of 13.4 passengers.

Exhibit 24



Systems with large numbers of transit dependents experience a great degree of boarding and alighting activity. People with limited access to automobiles (whether by choice or by circumstance) rely on mass transit (or taxis) to meet the needs of daily living. Transit routes in selective corridors serving major trip attractors, such as hospitals, universities, etc., can experience a high degree of seat turnover as the bus progresses from one neighborhood to another. This also serves to increase the efficient use of vehicle capacity.

Average load factor, combined with the average trip length above, suggests the intense ridership pattern of larger cities. Smaller systems may experience more of a concentrated destination pattern, with low ridership on outer fringes, building up to a peak at a particular trip attractor, such as a regional retail mall.

These are generalizations, but patterns are revealed in differences. It is worthwhile to look at these broad patterns as tools for comparing individual performance. Individual systems and individual routes can be readily compared using these same Section 15 data tools.

Service Consumption by Size of Urbanized Area

Exhibit 25 provides a tabular preview of the graphics that follow. Large urbanized areas provided the majority of the nation's passenger trips and passenger miles. Effectiveness measures, such as load factors and passenger trips per vehicle revenue hour, increased significantly with the increase in size of urbanized area.

Market Share

Large urbanized areas dominate the industry in terms of service consumed, as well as service supplied (Exhibits 26 and 27).

Exhibit 25

Overview: Service Consumption by Size of Urbanized Area

UZA Size	Measures				
	Unlinked Passenger Trips (millions)	Passenger Miles (millions)	Average Trip Length (miles)	Average Load Factor	Unlinked Passenger Trips per Vehicle Revenue Hour
Under 200,000	220.6	799.7	3.6	5.3	19.8
200,000 to 1 Million	669.8	2,662.0	4.0	8.1	28.2
Over 1 Million	7,075.1	34,529.0	4.9	17.4	53.0
Weighted Average	-	-	4.8	15.4	47.2
Total	7,965.6	37,990.8	-	-	-

Note: Slight deviations in totals may occur due to rounding.

Exhibit 26

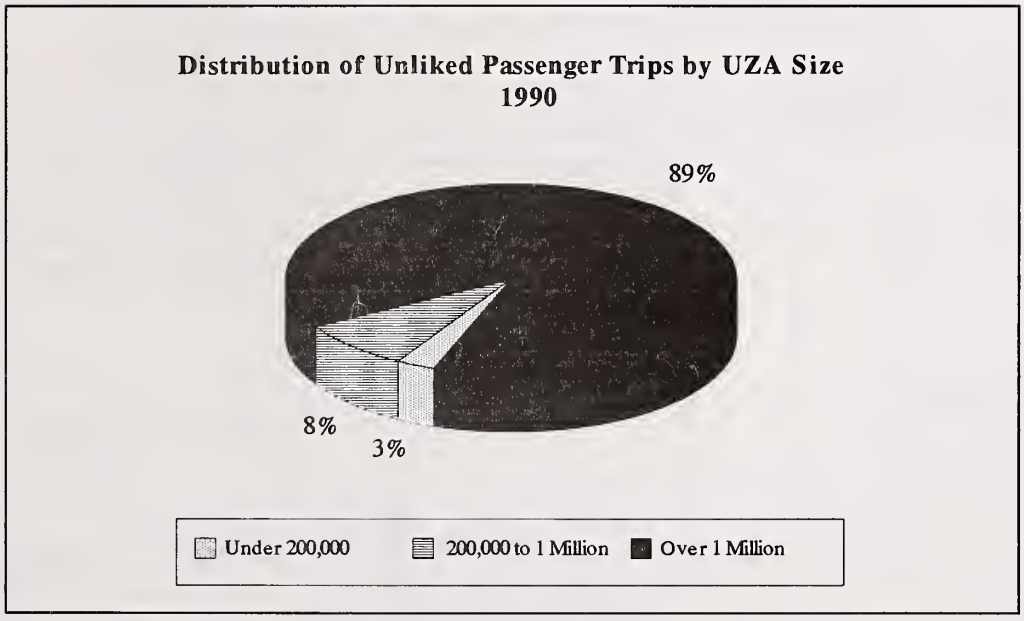
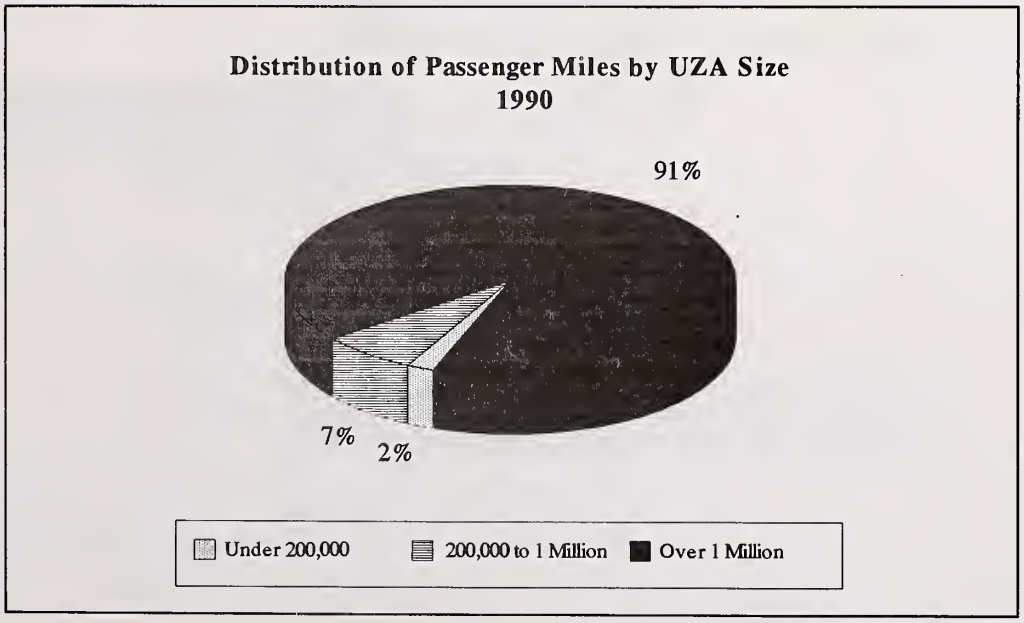


Exhibit 27



- Urbanized areas with over one million population accounted for 89 percent of unlinked passenger trips and 91 percent of passenger miles. They were served by 194 reporting transit systems of various sizes.

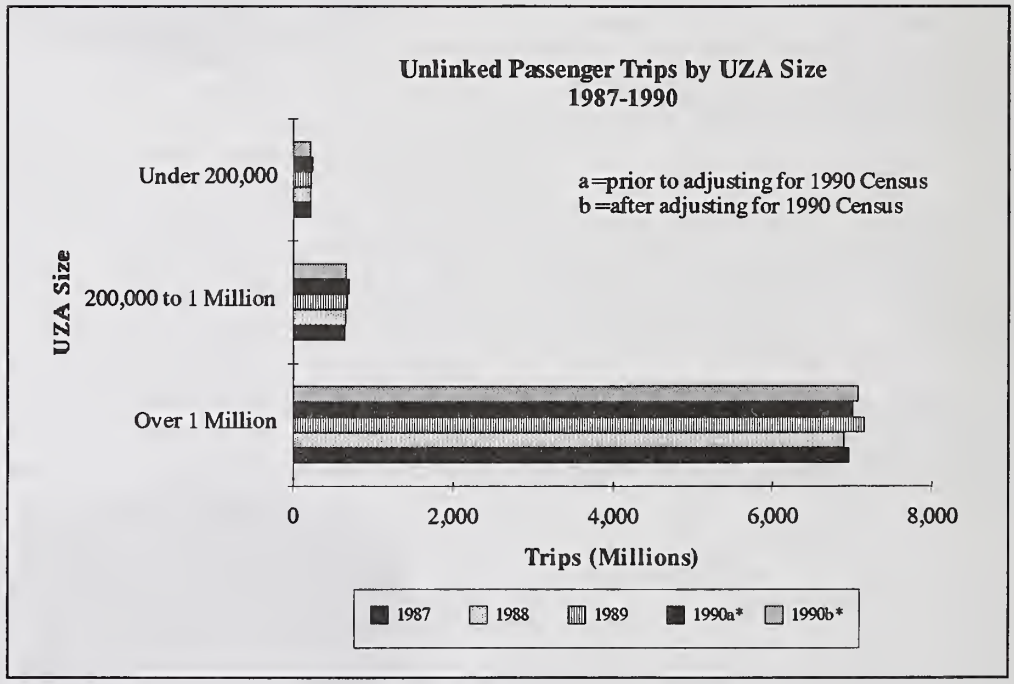
- Mid-sized UZAs, between 200,000 and 1,000,000 population, consumed eight percent of the passenger trips and seven percent of the passenger miles. They were served by 116 systems of various sizes, or about 22 percent of the total.

- Small UZAs, below 200,000 in population, represented 208 systems or about 40 percent of the total. They served 220 million passengers, or three percent of the passenger trips. Their riders produced two percent of total passenger miles.

Unlinked Passenger Trips by UZA Size

The trend in unlinked passenger trips by size of UZA (Exhibit 28) is distorted somewhat due to census adjustments. Some UZAs moved from one population grouping to another between 1989 and 1990. Exhibit 28 has the pre-1990 census figures as 1990a for each group, with post-census figures as 1990b. The pattern is similar to that which will be seen in service miles supplied (to be discussed in Chapter 3). Total ridership, as described in ridership by mode, above, increased by 1.3 percent since 1987.

Exhibit 28



Before the 1990 Census:

- Before adjusting for the census, small UZAs showed the largest growth in unlinked passenger trips. This growth includes a 13.6 percent increase over 1987, and a 7.6 percent increase over 1989.

- UZAs between 200,000 and 1,000,000 population experienced a growth of 7.8 percent over 1987, and a 3.8 percent growth over 1989.

- Large UZAs showed a 1.0 percent increase over 1987 and a 2.1 percent decline from 1989.

Effects from the 1990 Census:

- After adjusting for the census, small UZAs showed a four percent decline since 1989. This affects the increase since 1987, which showed only a 0.1 percent change.

- Mid-size UZAs showed a two percent decline from 1989. The growth since 1987 shrank to 3.2 percent.

- Large UZAs showed a 1.1 percent decline from 1989, rather than a 2.1 percent decline. The growth since 1987 is 1.6 percent.

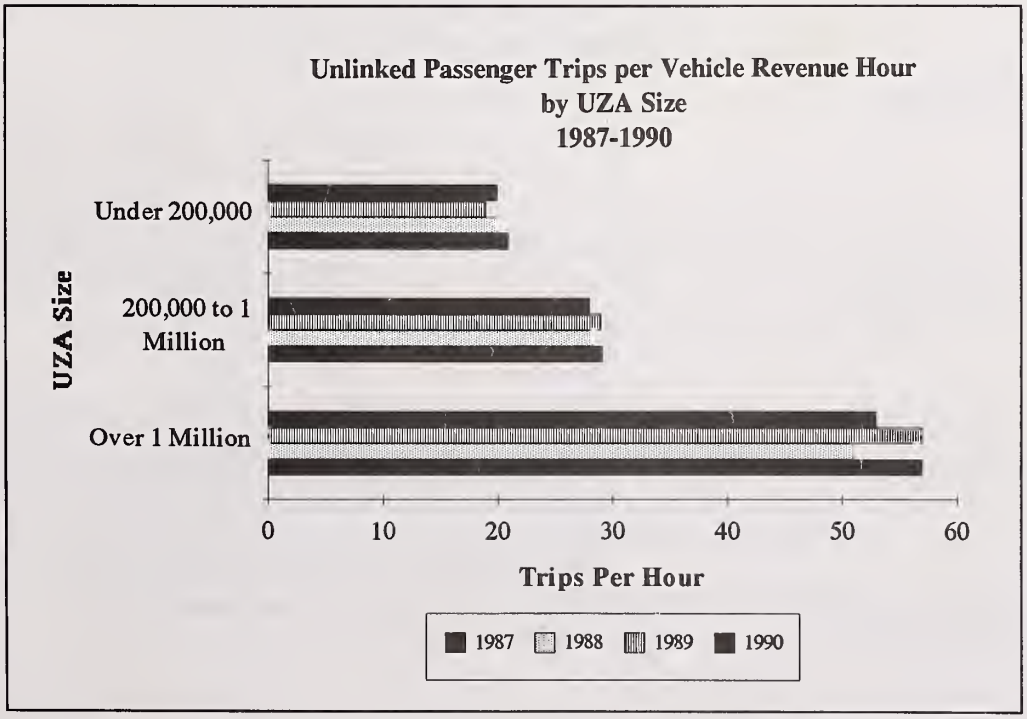
This before-and-after comparison suggests that the greatest growth in transit usage parallels the growth in population.

Performance Indicators

Service Effectiveness: Unlinked Passenger Trips per Vehicle Revenue Hour by UZA Size

Large UZAs are most productive of boardings per vehicle hour (Exhibit 29).

Exhibit 29



- Large UZAs averaged about 53 unlinked passenger trips per hour. This is more than double the rate in small UZAs. As noted above, large bus systems are more productive in this measure than small systems. In addition, large UZAs relied on the rail modes, which are generally more suited for high density, congested areas. The pattern of boardings per hour fluctuated, dropping nine percent from 1987 to 1988 (from 57 to 51), rebounding to 57 in 1989, and dropping again by six percent from 1989 to 1990. The decline from 1987 to 1990 totals 6.9 percent. This mainly reflects patterns in non-bus modes, since large bus systems have remained fairly stable over the years in question.

- Mid-size UZAs averaged about 28 boardings per vehicle hour. The pattern here has been stable since 1988, and represents less than a three percent decline from the 1987 level of 29 trips per hour.

- Small UZAs (under 200,000 population) averaged 20 boardings per hour. Small UZAs relied almost exclusively on Bus with relatively high proportions of Demand Response service. The pattern involves a decline from a level of almost 21 trips per hour in 1987 to 19.5 trips in 1988, declining again to 19 trips in 1989, and rebuilding to almost 20 trips per hour in 1990. As noted above, small bus systems increased in productivity. However, significant increases in Demand Response services, with low service efficiency measures, offset other productivity increases.

Service Consumption by Region

Exhibit 30 provides a tabular preview of the graphic data and indicators to follow. The Northeast region provided the largest share of the nation's passenger trips and passenger miles. Regions with the highest concentrations of large urbanized areas also exhibited the highest effectiveness measures, such as load factors and passenger trips per vehicle revenue hour.

Exhibit 30

Overview: Service Consumption by Region*

Region	Measures			
	Unlinked Passenger Trips (millions)	Passenger Miles (millions)	Unlinked Passenger Trips per Vehicle Revenue Hour	Passenger Miles per Vehicle Revenue Hour
Mid-Atlantic	1,018.0	4,169.8	51	211
North Central*	1,360.4	6,284.0	40	182
Northeast	3,321.7	17,376.5	61	320
South/Southwest*	805.1	3,456.5	31	134
West	1,460.4	6,704.0	43	197
Weighted Average	-	-	47	225
Total	7,965.6	37,990.8	-	-

*Two agencies reported questionable passenger trips and passenger miles data in prior years, which skewed trends and averages. Those two reports were deleted from this analysis.
Note: Slight deviations in totals may occur due to rounding.

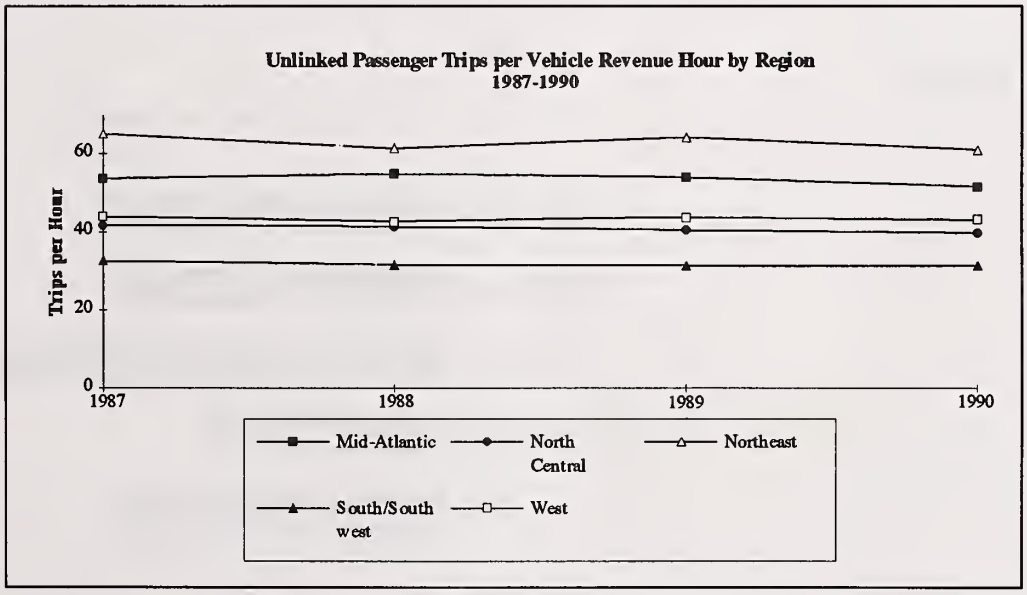
Service Effectiveness: Unlinked Passenger Trips per Vehicle Revenue Hour by Region

Exhibit 31 reveals the regional patterns of unlinked passenger trips per vehicle hour. Regional patterns, like patterns by size of Urbanized area, reflect the choices of modes and the intensities of development. Boardings per hour also reflect the mix and relative sizes of urbanized areas in each region.

Average trips per hour declined by six percent from 1987 to 1990, with an average of 47.3 trips per hour. The 1987 average was 50.3 trips per hour.

- The top 30 transit systems in the country, ranked in terms of total operating expense, accounted for over two-thirds of all the passenger trips and passenger miles in the country. Therefore, in this introduction to the discussion by regions, those key urbanized areas will be mentioned.

Exhibit 31



- The Mid-Atlantic region includes major metropolitan areas such as Baltimore, Philadelphia, Pittsburgh, and Washington DC. The Mid-Atlantic region averaged 51 trips per hour. Trips per hour declined four percent from 1987 to 1990.

- The North Central region includes the metropolitan areas of Chicago, Cleveland, Denver, Detroit, Minneapolis-St. Paul, and St. Louis. The North Central region was close to the average of the West, at 40 trips per hour. Trips per hour declined five percent during the four year period.

- The Northeast, led by service in and around New York City/Newark, also includes the Boston area. The Northeast was the busiest region, at 61 trips per

hour. The region averaged about 20 percent more passenger trips per hour than the Mid-Atlantic region. Trips per hour declined six percent during the period.

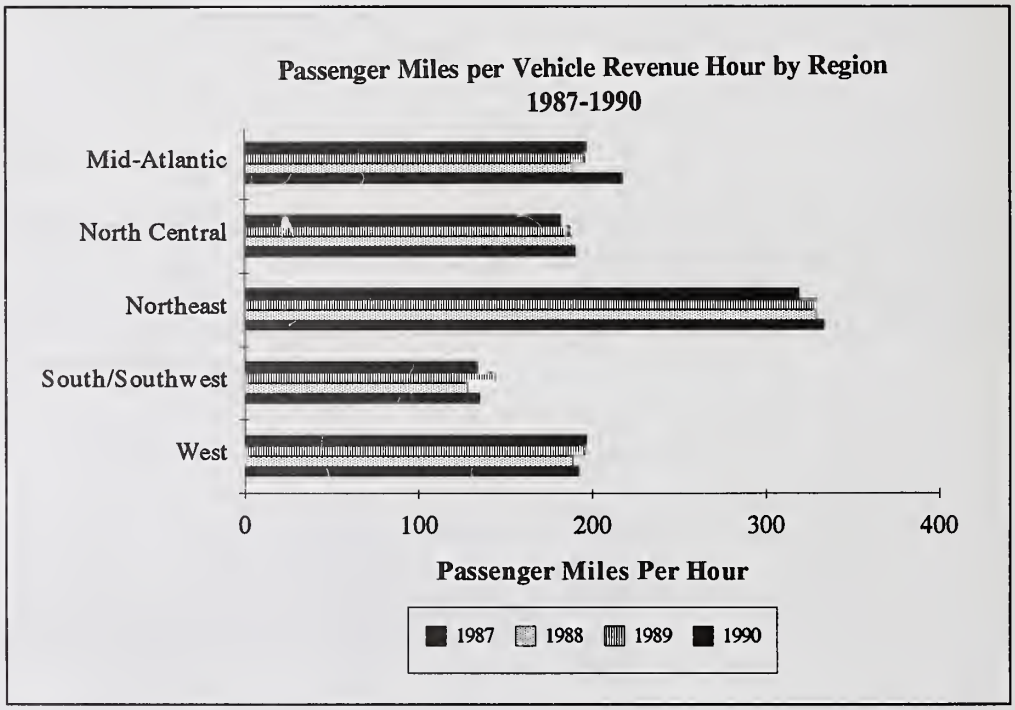
- The South-Southwest includes the metropolitan areas of Atlanta, Dallas, Houston, Miami and New Orleans. The South-Southwest averaged 31 trips per hour, or about half the level of the Northeast. Trips per hour declined four percent from 1987 to 1990.

- The West includes the metropolitan areas of Honolulu, Los Angeles, Portland, San Diego, San Francisco/Oakland, San Jose, and Seattle. The West averaged 43 boardings per hour. Trips per hour declined two percent during the four year period.

Service Efficiency: Passenger Miles Per Vehicle Revenue Hour by Region

Passenger miles per vehicle revenue hour adds the perspective of distance traveled to the boardings discussed above. The difference between the Northeast region and the remainder of the country becomes even more pronounced (Exhibit 32).

Exhibit 32



- The Mid-Atlantic region ranks second to the Northeast in this measure, averaging 211 passenger miles for each hour of service. This represents a decline of about three percent from the 1987 level of 218 passenger miles per vehicle revenue hour.

- Transit in the Northeast carried 320 passenger miles for every vehicle revenue hour. This is about 50 percent higher than the level in the Mid-Atlantic. It reflects the combination of Commuter Rail, Heavy Rail, and commuter bus networks of this region. Average service utilization under this measure declined by four percent from the 1987 level of 334 passenger miles per vehicle revenue hour.

- The North-Central region averaged 183 passenger miles per hour. Service utilization declined by four percent from the 1987 level of 191 passenger miles per vehicle revenue hour.

- The South-Southwest region achieved 134 passenger miles per hour, a little less than half the volume of the Northeast. This represents a decline of about one percent from the 1987 average of 136 passenger miles per vehicle revenue hour.

- The West is similar to the Mid-Atlantic, averaging 197 passenger miles per hour. The West was the only region that showed a productivity increase in this measure since 1987. Service utilization increased by two percent from the 1987 level of 193 passenger miles per vehicle revenue hour.

Chapter 3

Service Supplied

Introduction

Service supplied is strongly related to service consumed. Service consumption, discussed in Chapter 2, reviewed general trends of growth by mode. The performance measures that followed compared service consumption (passenger miles and unlinked passenger trips) to service supplied with subsets by mode, system size, UZA size, and region.

This chapter discusses general trends and performance measures related to service supplied. The general trends in service supplied have already been compared to trends in service consumed, through the service consumption performance measures discussed above. Some declines in the performance measures may seem to run counter to the general growth in passenger trips and passenger miles, but, as discussed in this chapter, significant increases in service have been undertaken to attract more passengers. For example, declines in Demand Response passenger trips per vehicle revenue mile resulted when service was increased at a greater rate than the number of passengers. Some service increases have been mentioned in the discussion of performance changes, but this chapter provides the full context.

The question of how much service is supplied is answered in terms of:

- Annual vehicle revenue miles,
- Annual vehicle revenue hours, and
- Total vehicles made available for passenger service.

Vehicle revenue miles and hours reflect the total distances and times traveled by vehicles while in revenue service (i.e., vehicles ready to pick up, carry, and discharge passengers). Total vehicles are defined as the maximum number of vehicles required during the year for regular service, excluding spares and special events.

Discussing both miles and hours may seem redundant; however, they reveal different aspects of service. Hours are more closely associated with expense, since operator wages are paid based on hours, without regard to distance traveled. Comparisons based on hours also eliminate the advantage of speed held by certain modes or less densely populated urbanized areas. Miles, on the other hand, may present a more accurate measure of service supplied from the perspective of the customer, since transit is used to travel from one place to another. Miles and hours can be easily compared to one another in the aspect of average operating speed. It is neither a measure of efficiency nor effectiveness; however, it provides a clear indicator of an important aspect of service to the customer.

Chapter Organization

This chapter follows the same pattern of organization as the previous chapter. It is divided into four sections, with information by Mode receiving the greatest emphasis.

Modes

The various modes are compared on the volume of service supplied, trends in service, including type of service, average speed, and annual miles per vehicle. Miles per vehicle influences maintenance schedules and capital replacement requirements.

Size of Bus Fleet

The performance and service characteristic measures that were compared by mode are compared here by size of bus fleet (the number of buses required in maximum service.)

Size of Urbanized Area

Selected service factors and trends are next examined based on the size of the urbanized area. Much of the discussion refers to the information established during the discussions of modes and bus system sizes, as these are often key determinants of performance measures for an urbanized area.

Regions

Finally, a few factors are examined by region, to present a glimpse of the effects of geography and historical development patterns on transit.

Related Measures

Standard service efficiency measures such as operating expense per vehicle revenue hour and vehicle revenue hours per employee are discussed in the chapter that follows, within the context of total operating expense and other service inputs.

Service effectiveness measures such as unlinked passenger trips per vehicle revenue hour and passenger miles per vehicle revenue mile were reviewed in the previous chapter within the context of service consumption.

The 518 transit systems reporting for fiscal year 1990 supplied 2.47 billion revenue miles and 169 million revenue hours of service. This is equivalent to driving from New York to Los Angeles 2,425 times a day, 365 days a year.

Service Supplied by Mode

Overview: Service Supplied by Mode (Exhibit 33) summarizes significant information from the following section. Consistent with service consumed information, Bus supplies the largest volume of service miles and hours. The modes exhibit wide variances in the key operating statistic, average vehicle speed, with Commuter Rail averaging the highest speeds. Vehicle usage, as revealed in annual miles per vehicle, also varies widely, with Heavy Rail experiencing the most intense use.

Market Share of Service Supplied

Distribution of Annual Vehicle Revenue Miles by Mode (Exhibit 34) and Distribution of Annual Vehicle Revenue Hours by Mode (Exhibit 35) display the proportionate shares of miles and hours among the modes. Bus is clearly dominant in both realms, followed by Heavy Rail.

Exhibit 33

Overview: Service Supplied by Mode
1990

Mode	Measures				
	Vehicle Revenue Miles (millions)	Vehicle Revenue Hours (millions)	Vehicles in Maximum Service	Average Speed	Annual Miles/Vehicle (thousands)
Bus	1,534.5	120.1	42,869	12.7	35.5
Heavy Rail	520.8	26.3	8,347	19.8	62.4
Commuter Rail	193.1	6.0	4,163	32.0	46.4
Light Rail	36.3	3.5	1,148	10.4	31.6
Demand Response	171.2	12.3	7,903	13.4	22.9
Other	10.9	.7	712	15.8	15.3
Weighted Average	-	-	-	14.6	39.6
Total	2,466.8	168.9	65,142	-	-

Note: Slight deviations in totals may occur due to rounding.

The key differences between the two exhibits result from differences in average speed between the modes (see Exhibit 42 in this chapter.) Modes that supply a higher percentage of miles than hours exhibit higher speeds. Commuter Rail, for example, supplied eight percent of vehicle revenue miles and only four percent of vehicle revenue hours, due to its high speeds. Bus supplied 62 percent of all vehicle revenue miles, and 71 percent of all vehicle revenue hours, indicating lower speeds than Heavy Rail and Commuter Rail.

Exhibit 34

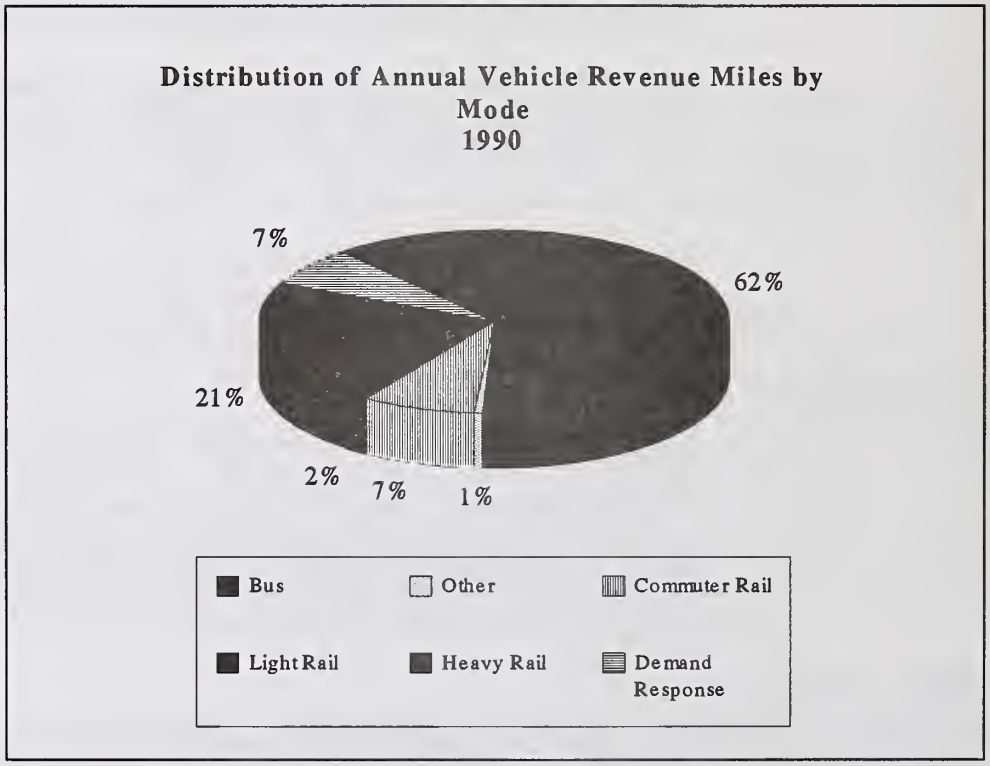
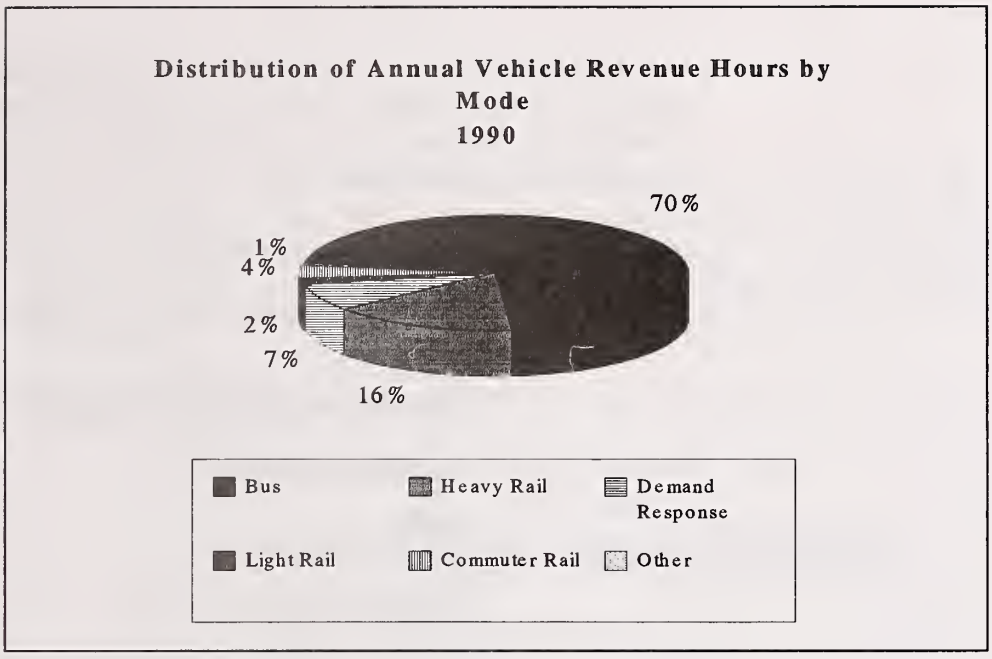


Exhibit 35



Detail of Service Supplied by Mode

Vehicle Revenue Miles by Mode and Type of Service (Exhibit 36) subdivides the 1990 miles of service supplied into directly operated and purchased services. Vehicle Revenue Miles by Mode (Exhibit 37) displays the four year trend of total service supplied by mode, without distinguishing between purchased service and directly operated service. Vehicle Revenue Miles by Mode and Type of Service (Exhibit 38) and Vehicle Revenue Hours by Mode and Type of Service (Exhibit 39) provide the four year detail of miles and hours in tabular format, including the segregation of purchased service and directly operated service.

Vehicle Revenue Miles by Mode and Type of Service

The Federal emphasis on privatization and the transit industry emphasis on cost containment have combined to increase the role of Purchased Transportation services. (Exhibit 36)

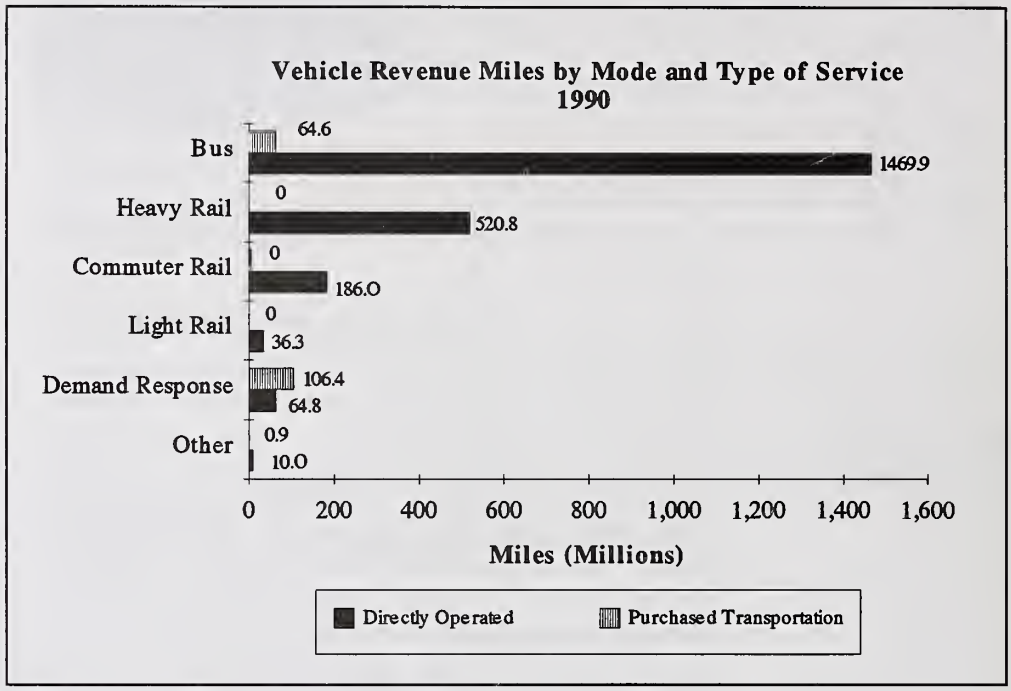
Purchased Transportation supplied most Demand Response services (62 percent). This continues the patterns of prior years. Tremendous growth occurred in both directly operated and purchased Demand Response service since 1987.

- Directly operated Demand Response service increased 72 percent since 1987. This represents an average increase of 20 percent per year.

- Purchased Demand Response service increased 41 percent during the same period, or about 12 percent per year.

- Demand Response as a whole represents approximately seven percent of all service miles supplied. However, its role is increasing, and will likely continue to increase with the implementation of the requirements of the Americans with Disabilities Act.

Exhibit 36



Purchased Transportation represents a small portion of Bus service; however, its role is increasing.

- More than four percent of all Bus service was provided through Purchased Transportation. 1990 Purchased Transportation service totaled approximately 64.6 million miles.

- The 1990 level of purchased Bus transportation service represents a 63 percent increase over the level of 1987, with increases averaging about 18 percent per year. The increase from 1989 to 1990 was a full 26 percent.

- During this period, since 1987, directly operated service increased by less than one percent.

Less than four percent of Commuter Rail service was provided through Purchased Transportation. This level remained stable over the four year period.

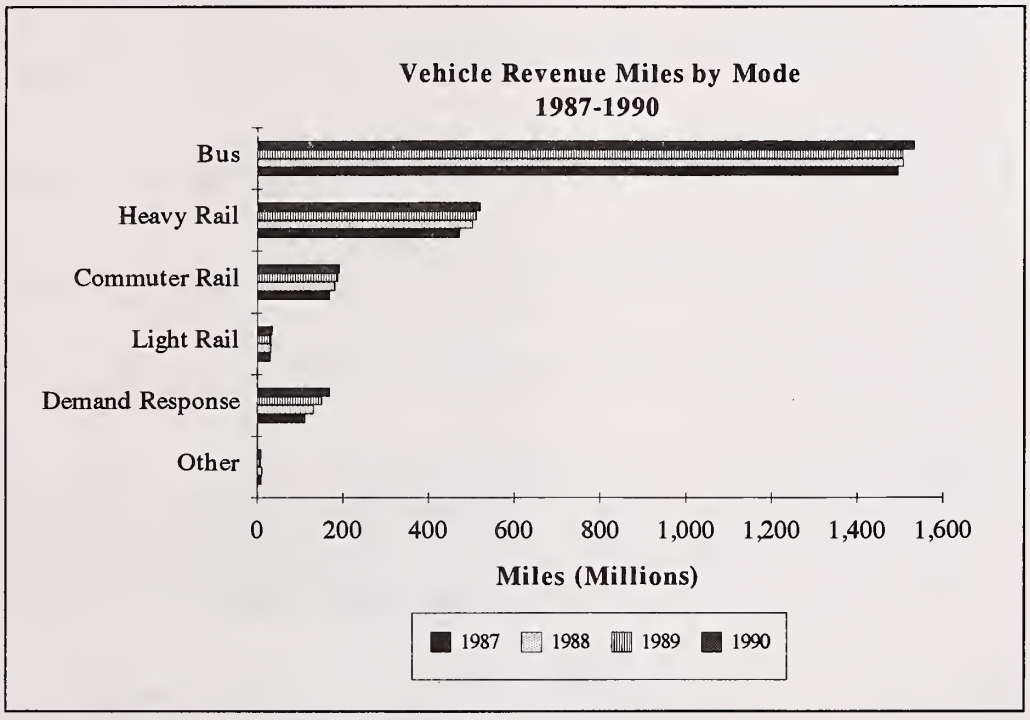
Heavy Rail does not use Purchased Transportation service. The role of Purchased Transportation service in Light Rail was insignificant at less than 0.1 percent.

Trends in Service Supplied

Vehicle Revenue Miles by Mode

Exhibit 37 displays total miles by mode, revealing an increase of 168.8 million miles or 7.3 percent since 1987. This is an average increase of 2.3 percent per year. Exhibit 38 displays the same information in tabular format, including the distinction between purchased service and directly operated service discussed above.

Exhibit 37



- Demand Response service experienced the greatest absolute growth and the greatest growth rate, expanding miles of revenue service by 57.8 million miles and by 51 percent over four years. As a result, Demand Response service increased its share of total miles from less than five percent to almost seven percent.

- Heavy Rail experienced the second largest absolute growth in miles, increasing by 46.9 million miles or 9.9 percent since 1987. Service expansion and the opening of new segments on existing systems are the primary reasons.

- Bus is close behind Heavy Rail in absolute terms, increasing by 37.3 million miles or 2.5 percent. As noted earlier, more than half the growth was in Purchased Transportation miles of service.

- Commuter Rail grew steadily, by 23.1 million miles or 13.6 percent during the four year period. This increase is attributable to service expansion, the addition of a new system, and commencement of operations of new segments of existing systems.

Exhibit 38

Vehicle Revenue Miles by
Mode and Type of Service
(millions)
1987-1990

Mode/Type of Service	Years			
	1987	1988	1989	1990
Bus				
Directly Operated	1,457.7	1,466.7	1,455.2	1,469.9
Purchased Transportation	39.5	41.8	51.1	64.6
Total	1,497.2	1,508.5	1,506.3	1,534.5
Heavy Rail				
Directly Operated	473.9	503.0	513.1	520.8
Purchased Transportation	0	0	0	0
Total	473.9	503.0	513.1	520.8
Commuter Rail				
Directly Operated	162.9	175.3	182.5	186.0
Purchased Transportation	7.0	8.2	7.7	7.0
Total	169.9	183.5	190.2	193.1
Light Rail				
Directly Operated	32.4	34.2	34.5	36.3
Purchased Transportation	0	0	0	0
Total	32.4	34.2	34.5	36.3
Demand Response				
Directly Operated	37.7	41.0	56.0	64.8
Purchased Transportation	75.7	91.8	96.1	106.4
Total	113.4	132.8	152.1	171.2
Other				
Directly Operated	10.2	11.5	8.9	10.0
Purchased Transportation	1.0	1.4	.2	.9
Total	11.2	12.9	9.1	10.9
Total Directly Operated	2,174.8	2,231.7	2,250.2	2,287.8
Total Purchased Transportation	123.2	143.2	155.1	179.0
Total	2,298.0	2,374.9	2,405.3	2,466.8

Note: Slight deviations in totals may occur due to rounding.

Exhibit 39 provides information similar to Exhibit 38, except by vehicle revenue hours. For the transit industry as a whole, the increase in total vehicle revenue hours was 11.6 million hours or 7.4 percent since 1987. An increase of 42 percent in Purchased Transportation was observed since 1987; as a result, Purchased Transportation accounted for 6.9 percent of hours in 1990.

- Demand Response service experienced the greatest growth rate with an increase of 52 percent over the four years. Both Directly Operated and Purchased Transportation services increased, by 84 percent and 37.5 percent.

  Demand Response increased from slightly more than eight percent to more than 12 percent in its share of the total vehicle revenue hours. The absolute increase over the four years was slightly less than Bus.

- Bus experienced growth of 4.4 million vehicle revenue hours during this period, the largest absolute increase of any mode. This increase was slightly greater than Demand Response. Purchased Transportation increased by over 62 percent. In comparison to Directly Operated service, Purchased Transportation increased its share of the bus mode from slightly less than one percent in 1987 to slightly over three percent in 1990.

Exhibit 39

Vehicle Revenue Hours by Mode and Type of Service (millions) 1987-1990

Mode/Type of Service	Years 1987	1988	1989	1990
Bus				
Directly Operated	113.3	123.4	113.5	116.2
Purchased Transportation	2.4	2.6	3.1	3.9
Total	115.7	126.0	116.6	120.1
Heavy Rail				
Directly Operated	24.3	25.4	26.2	26.3
Purchased Transportation	0	0	0	0
Total	24.3	25.4	26.2	26.3
Commuter Rail				
Directly Operated	5.1	5.7	5.9	5.9
Purchased Transportation	.2	.2	.2	.2
Total	5.3	5.9	6.1	6.0
Light Rail				
Directly Operated	3.3	3.4	3.3	3.5
Purchased Transportation	0	0	0	0
Total	3.3	3.4	3.3	3.5
Demand Response				
Directly Operated	2.5	2.9	3.8	4.6
Purchased Transportation	5.6	6.6	7.0	7.7
Total	8.1	9.5	10.8	12.3
Other				
Directly Operated	.5	.6	.6	.6
Purchased Transportation	.1	.1	.0	.1
Total	.6	.7	.6	.7
Total Directly Operated	149.0	161.4	153.3	157.1
Total Purchased Transportation	8.3	9.5	10.3	11.8
Total	157.3	170.9	163.6	168.9

Note: Slight deviations in totals may occur due to rounding.

- Commuter Rail increased 13 percent during the period. The entire increase occurred in directly operated service. This increase is due to service expansion, a new system start-up, and the commencement of new operating segments to existing systems.

- Heavy Rail grew by over eight percent as the result of service expansion and the opening of new segments on existing systems.

- Light Rail incurred a six percent growth as the result of new system starts and the opening of line extensions and new segments.

Vehicles Operated in Maximum Service by Mode

Exhibits 40 and 41 display the increase in the number of vehicles in maximum service over four years. Total vehicles increased by over 3,600 vehicles or approximately six percent. Directly operated vehicles in maximum service increased by four percent, while purchased transportation vehicles increased by 19 percent. This change took place concurrent with increases in revenue service miles.

Exhibit 40

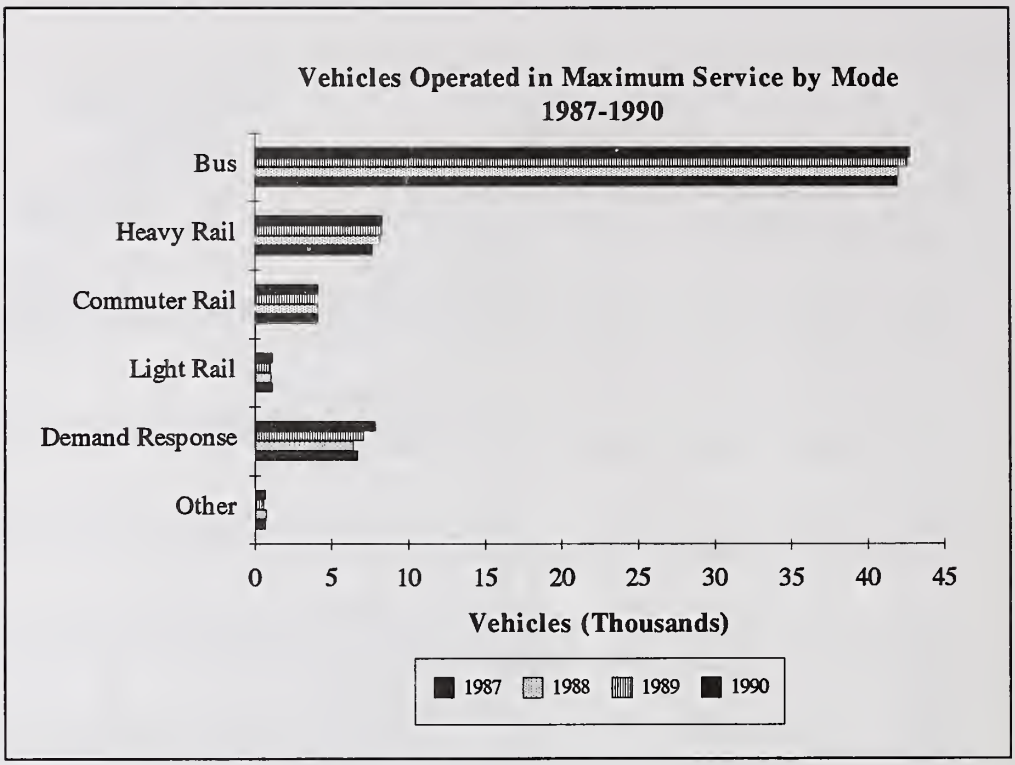


Exhibit 41

Vehicles Operated in Maximum Service
by Mode and Type of Service
1987-1990

Mode/Type of Service	Years			
	1987	1988	1989	1990
Bus				
Directly Operated	40,838	40,768	41,016	40,840
Purchased Transportation	1,197	1,300	1,672	2,029
Total	42,035	42,068	42,688	42,869
Heavy Rail				
Directly Operated	7,731	8,182	8,306	8,347
Purchased Transportation	0	0	0	0
Total	7,731	8,182	8,306	8,347
Commuter Rail				
Directly Operated	3,919	3,844	3,828	3,922
Purchased Transportation	251	288	286	241
Total	4,170	4,132	4,114	4,163
Light Rail				
Directly Operated	1,158	1,081	1,026	1,144
Purchased Transportation	0	1	4	4
Total	1,158	1,082	1,030	1,148
Demand Response				
Directly Operated	1,538	1,780	2,118	2,627
Purchased Transportation	4,178	4,665	4,997	5,276
Total	5,716	6,445	7,115	7,903
Other				
Directly Operated	621	683	550	630
Purchased Transportation	103	84	35	82
Total	724	767	585	712
Total Directly Operated	55,805	56,338	56,844	57,510
Total Purchased Transportation	5,729	6,338	6,994	7,632
Total	61,534	62,676	63,838	65,142

Note: Slight deviations in totals may occur due to rounding.

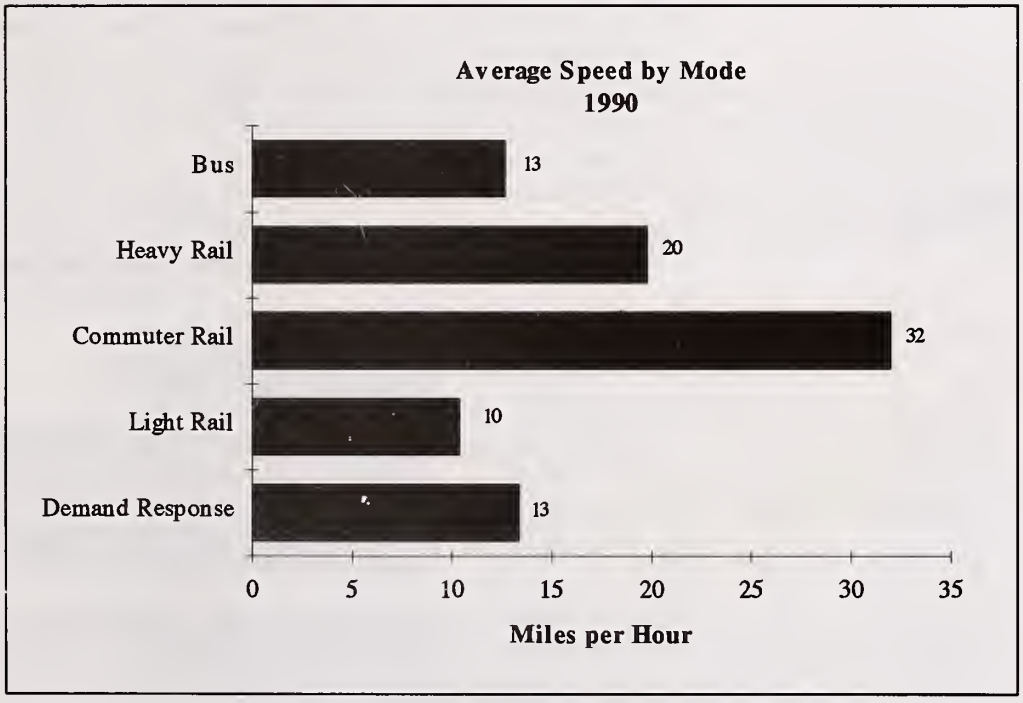
- Bus vehicular fleets experienced an increase of 834 vehicles or two percent. Almost half of the increase in vehicles is associated with purchased transportation.

- Heavy Rail experienced an 8.0 percent increase in vehicles during the four year period.

- Commuter Rail was able to increase its service miles significantly despite an actual decline of 47 vehicles after 1987. Vehicle counts were not consistent over the four years.

- Demand Response vehicles increased by 2,187 vehicles or 38 percent after 1987. Directly operated vehicles increased 71 percent, while purchased transportation vehicles increased 26 percent. In a straight count (irrespective of cost), Demand Response vehicles made up over 12 percent of the entire national transit system fleet.

Exhibit 42



Performance Indicators

Service Characteristic: Average Speed by Mode

A key difference noted among the modes, and perhaps of prime importance to the passenger, is the speed of each means of travel. Average vehicle speed varies greatly among modes, as observed in Exhibit 42.

- The fastest mode, Commuter Rail, averaged almost 32 miles per hour. It operates on fixed guideway with few stops.

- Heavy Rail averaged almost 20 miles per hour. Like Commuter Rail, it has a separated fixed guideway, but stops are closer together.

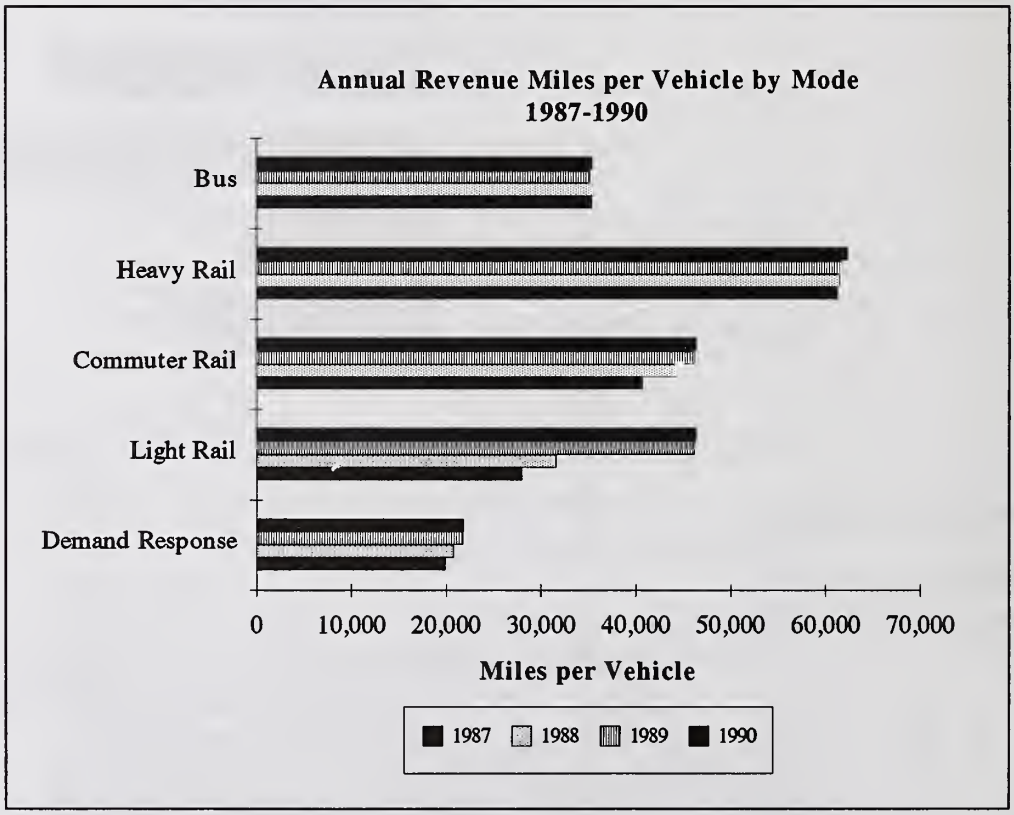
- Bus is faster than Light Rail, having averaged almost 13 miles per hour. Express services and separate High Occupancy Vehicle (HOV) lanes can give Bus most of the speed advantages of a Commuter Rail or Heavy Rail service. However, most Bus service operates in mixed traffic with frequent stops for boarding and alighting.

- Demand Response service averaged over 13 miles per hour. The advantage of limited stops may be offset by extended boarding times for passengers with limited mobility.

Capital Usage Characteristic: Annual Revenue Miles per Vehicle by Mode

The average miles operated by each vehicle during a year is a measure of the intensity of use. It affects maintenance cycles and requirements, and the ultimate life span of a vehicle. Annual Revenue Miles Per Vehicle by Mode (Exhibit 43) displays the four year trend in average revenue miles per vehicle. Heavy Rail is consistently the highest, with 1990 representing a peak in vehicle utilization.

Exhibit 43



- Heavy Rail placed the most intense mileage burden on its cars each year, at 62,400 revenue miles per vehicle in maximum service.

- The Commuter Rail average is almost 46,400 miles per car, which is about two-thirds of the Heavy Rail average.

- Bus averaged almost 35,500 revenue miles per bus per year.

- Demand Response service had the lowest utilization of the major modes, averaging less than 22,000 miles per vehicle per year. This is about one-third the utilization of a Heavy Rail vehicle.

It should be noted that the above analysis includes only revenue miles, not total miles including deadhead. Also note that the analysis does not include spare vehicles. Higher levels of spare vehicles will spread the burden and lower the averages. Spare ratios by mode and size of bus fleet are discussed in Chapter 5, in the section on Capital funding.

Service Supplied by Size of Bus System

Exhibit 44 summarizes significant information from the following section on service supplied by size of Bus system. The largest systems (with over 250 buses) provided the majority of the nation's bus service miles and hours. Average vehicle speeds decrease with the increase in the size of the system. Smaller systems also have less difference between peak and midday levels of bus service than do large systems (peak to base ratio).

Exhibit 44

Overview: Service Supplied by Size of Bus Fleet
1990

Number of Buses	Measures				
	Vehicle Revenue Miles (millions)	Vehicle Revenue Hours (millions)	Average Speed	Peak to Base Ratio	Annual Miles per Bus (thousands)
Under 25	102.3	6.5	14.9	1.48	38.3
25-99	215.3	15.2	14.1	1.51	36.3
100-249	291.1	21.4	13.6	1.78	35.7
250 and over	925.8	77.0	12.0	1.90	35.0
Weighted Average	-	-	12.8	1.80	35.3
Total	1,534.5	120.1	-	-	-

Note: Slight deviations in totals may occur due to rounding.

Vehicle Revenue Hours by Size of Bus Fleet

Systems with over 100 vehicles provided 82 percent of the Bus service hours reported in the country. (Exhibit 45) This corresponds roughly to the service amount supplied to urbanized areas of over one million population. It should be noted that there is an overlap in categories, such as small systems serving large UZAs.

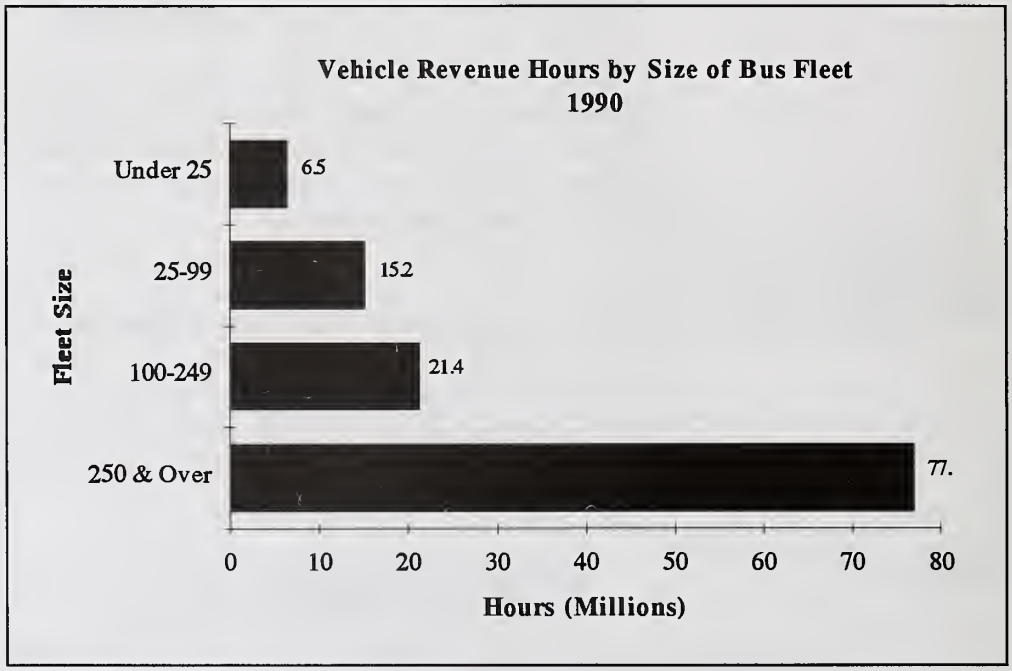
- Over 64 percent of the service hours were supplied by the 37 systems with more than 250 buses in maximum service.

- Eighteen percent of the service hours were supplied by 53 systems with 100 to 249 buses.

- One hundred twenty-four systems had 25 to 99 buses in maximum service; they provided almost 13 percent of the vehicle revenue hours in the country.

- Three hundred six systems, or almost 60 percent of all the Bus systems reporting in the country, had fewer than 25 buses. Together, they provided over five percent of total Bus service hours.

Exhibit 45



Performance Indicators

Service Characteristic: Average Speed by Size of Bus Fleet

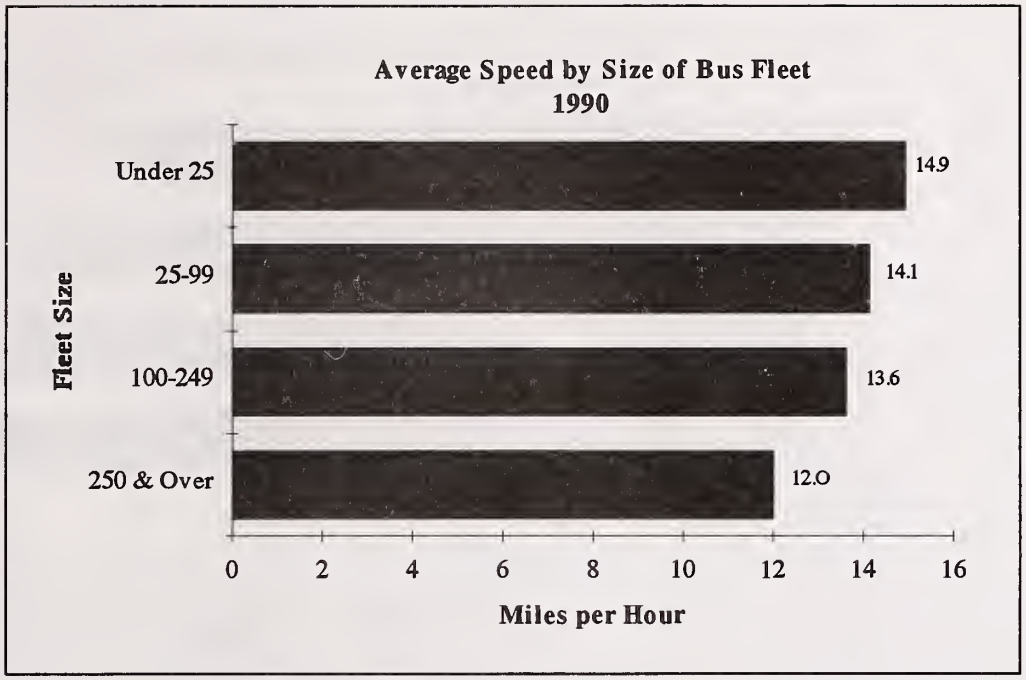
For 1990, the average vehicle speed for Bus varied depending upon the size of the system. (Exhibit 46)

- The smallest systems (with fewer than 25 vehicles) reported the highest speeds, averaging 14.9 miles per hour (mph). Small cities are typically less congested than larger cities. Some smaller systems also included many commuter services, associated with large UZAs, which typically experienced high average speeds.

- Systems from 25 to 99 vehicles averaged 14.1 mph

- Systems from 100 to 249 vehicles averaged 13.6 mph, about 13 percent faster than the largest systems.

Exhibit 46



- Large systems with over 250 vehicles reported the lowest average speeds, 12.0 mph. This may reflect the high level of traffic congestion in the large UZAs represented by these systems.

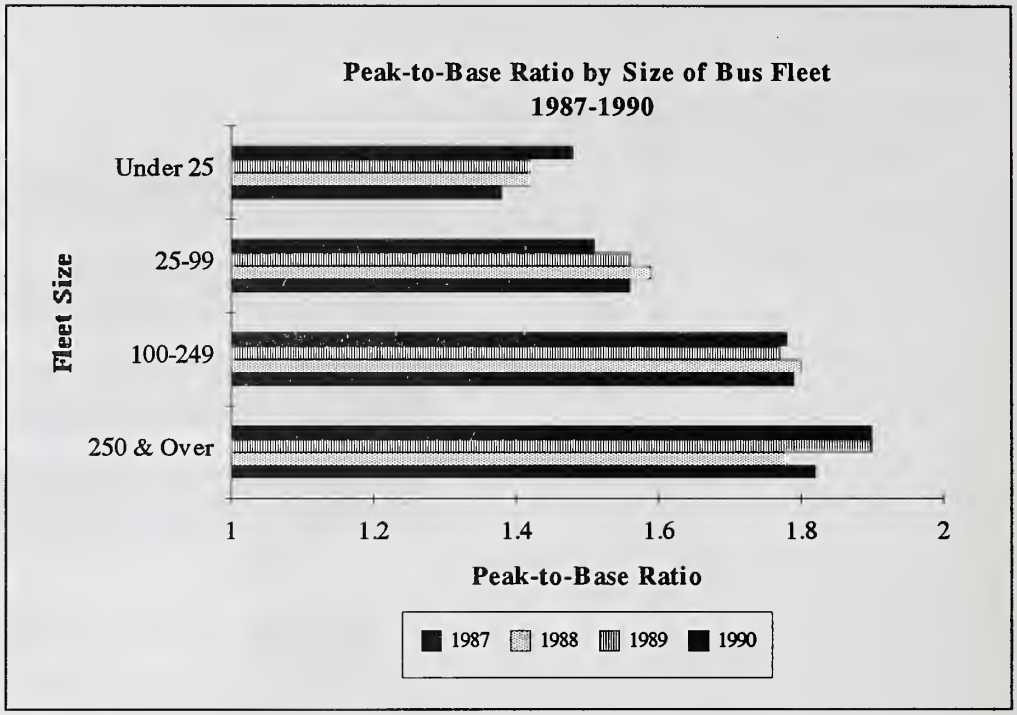
Service Characteristic: Peak-to-Base Ratio by Size of Bus Fleet

The peak-to-base ratio compares the maximum vehicle requirement to the mid-day vehicle requirement. The peak-to-base ratio measures the intensity of service required during the peak period of the day compared to the base period. (Exhibit 47)

A high peak-to-base ratio suggests that vehicle and operator requirements experienced wide daily swings. This in turn influences system-wide capital and labor requirements, since buses required to meet the peak requirement will be idle for portions of the day. Operator requirements at the peaks are generally met through combinations of part-time operators and spread time provisions in labor contracts. Spread time permits the bus system to split the operator work day into two sections, without paying for idle time between the work sections. Provisions for spread time vary greatly among bus systems, but the need for spread time, in broad terms, is generally set by the peak-to-base ratio.

Peak-to-base ratio is reviewed for Bus systems based on the size of bus fleet. National averages of the peak to base ratio vary significantly based on system size.

Exhibit 47



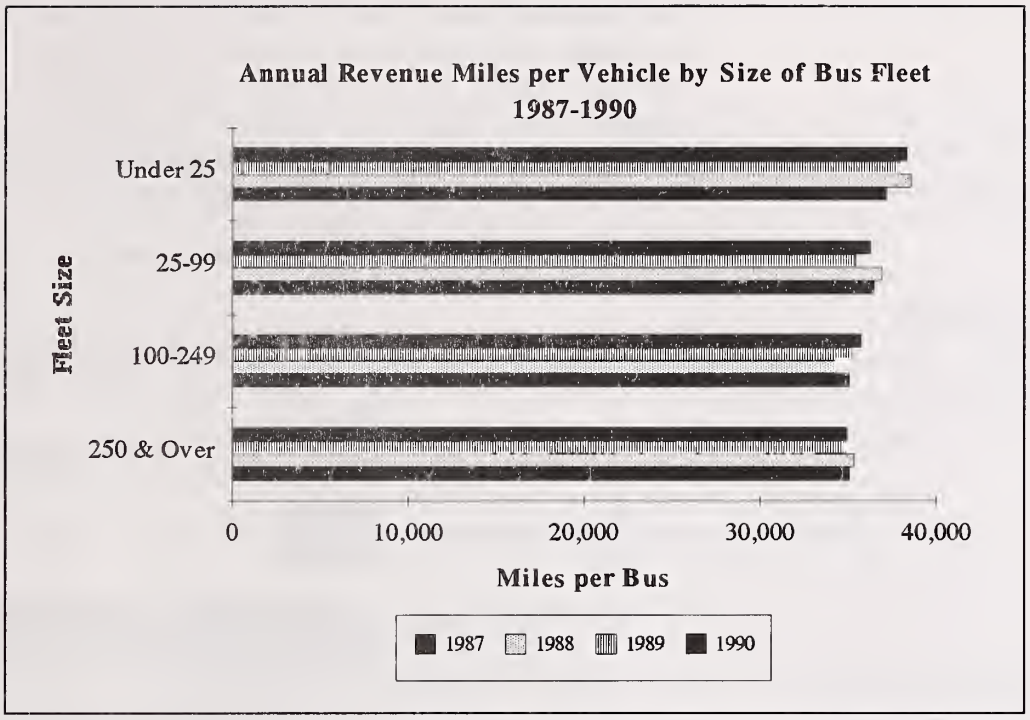
- The smallest systems averaged 1.48, meaning that peak service required almost 50 percent more buses than did base service.
- Systems between 25 and 99 buses averaged 1.51, which is very similar to the smallest systems.
- Systems between 100 and 249 buses averaged 1.78, resulting in the peak being more than three-fourths larger than the base.
- The largest systems with 250 buses or more averaged 1.90, resulting in the peak being close to double the base requirement.

Capital Characteristic: Annual Revenue Miles per Vehicle by Size of Bus Fleet

Average annual usage of buses also varies based on system size. Exhibit 48 shows the four year trend in annual miles per bus. The trend by system size is the inverse of the peak to base ratio. Systems with the lowest peak-to-base ratio have the highest mileage per vehicle in maximum service, and vice versa.

- The smallest systems had the highest usage in 1990, at 38,337 miles. A lower peak-to-base ratio means more of the buses are used all day, increasing the annual miles.
- Systems between 25 and 99 buses averaged 36,270 revenue miles per bus.

Exhibit 48



- Systems between 100 and 249 buses averaged 35,748 revenue miles per bus.

- Systems with 250 buses or more averaged 34,955 revenue miles per bus. This is about nine percent fewer miles per vehicle than the smallest systems. This is also about two percent less than their closest peer group, with between 100 and 249 buses.

Another factor to consider for this measure is that large systems typically operate in large UZAs with more congestion and lower speeds. Therefore, although total revenue miles per vehicle may be fewer, revenue hours of service per vehicle may be very similar. Some consider hours of service as a better indicator of wear than miles of service; however, there is no clear consensus on the issue.

Service Supplied by Size of Urbanized Area

Exhibit 49

Service Supplied by Size of Urbanized Area (Exhibit 49) previews significant information from the following section on service supplied by size of urbanized area. Additional data such as vehicle revenue hours and annual miles per vehicle are also included for comparison purposes.

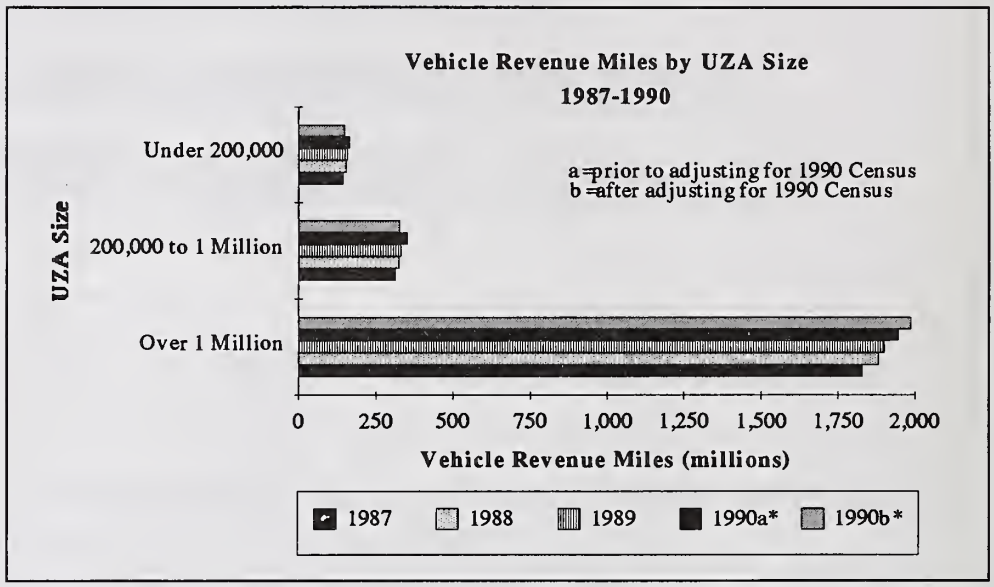
Overview: Service Supplied by Size of Urbanized Area 1990

UZA Size	Measures		
	Vehicle Revenue Miles (millions)	Vehicle Revenue Hours (millions)	Annual Miles per Vehicle (thousands)
Under 200,000	105.2	11.4	29.3
200,000 to 1 Million	328.6	23.7	32.0
Over 1 Million	1,988.0	133.8	39.7
Weighted Average	-	-	39.6
Total	2,466.8	168.9	-

Note: Slight deviations in totals may occur due to rounding.

The pattern of annual miles per vehicle is the reverse of the pattern by bus system size. Here, the larger UZAs experience higher miles per vehicle than the smaller UZAs. As noted above, smaller systems average more miles per bus than larger systems. This apparent inconsistency is due to the differences between modes. Small urbanized areas are characterized by Bus and Demand Response. These two modes have low average annual miles per vehicle. Large UZAs include rail modes, which have high miles per vehicle.

Exhibit 50



Vehicle Revenue Miles by UZA Size

Transit systems in larger urbanized areas provided the greatest proportion of total vehicle revenue miles and hours. (Exhibit 50)

- Residents of urbanized areas with over one million population were supplied with about 81 percent of transit revenue miles.

- Residents of urbanized areas with between 200,000 and one million population were supplied with about 13 percent of transit revenue miles.

- Residents of urbanized areas with between 50,000 and 200,000 population were supplied with about six percent of transit revenue miles.

Trends in service supplied are distorted because of the 1990 census. Some urbanized areas moved from one census category to another between 1989 and 1990. 1990a in the graph represents service before adjusting for the census. 1990b represents service after that adjustment.

- Small urbanized areas received over 167 million miles of service in 1990, a 3.6 percent increase over 1989. However, after graduating the cities that increased in size and dropping cities that no longer qualified, small UZAs lost 17.4 million miles. As a result, small UZAs experienced a seven percent decrease in

miles of service from 1989. This represents a three percent increase over 1987.

- Medium-size UZAs received about 353.2 million miles of service in 1990, a 5.9 percent increase over 1989. However, after adjusting for the census, these cities lost 25.6 million miles. As a result, these UZAs experienced a two percent decrease in miles of service from 1989. This represents a five percent increase over 1987.

- Large UZAs received about 1,948 million miles of service in 1990, a 2.4 percent increase over 1989. After adjusting for the census, these cities gained 40.4 million miles. As a result, these UZAs experienced a 4.5 percent increase in miles of service from 1989. This represents a net gain of almost nine percent over 1987.

Total service miles increased almost eight percent from 1987 to 1990.

Vehicles Operated in Maximum Service by UZA Size and Mode

Exhibit 51 supplies a comparison of vehicles operated in maximum service by mode and population. The distribution of modes varies based on the size of urbanized area.

Exhibit 51

Vehicles Operated in Maximum Service
UZA Size and Mode
1990

Mode	UZA Size			
	Under 200,000	200,000 to 1 Million	Over 1 Million	Total
Bus	3,286	8,011	31,572	42,869
Heavy Rail	0	0	8,347	8,347
Commuter Rail	0	10	4,153	4,163
Light Rail	4	49	1,095	1,148
Demand Response	1,727	2,026	4,150	7,903
Other	109	147	456	712
Total	5,126	10,243	49,773	65,142

Note: Slight deviations in totals may occur due to rounding.

- Heavy Rail is exclusively found in large UZAs.

- Commuter Rail is almost exclusive to large UZAs. Only ten vehicles out of more than 4,100 were used in smaller UZAs.

- Light Rail is predominantly found in large UZAs. However, about four percent of the vehicles were found in smaller UZAs.

- Small UZAs accounted for about 23 percent of all Demand Response vehicles and controlled less than eight percent of all buses.

- Medium-size UZAs controlled about 19 percent of all buses and about 26 percent of all Demand Response vehicles.

- Large UZAs controlled about 74 percent of all buses, but only about 52 percent of all Demand Response vehicles.

Service Supplied by Region

Service Supplied by Region (Exhibit 52) summarizes service supplied by region. The Northeast region supplied the greatest amount of service in the country, consistent with service consumed.

Exhibit 52

Overview: Service Supplied by Region
1990

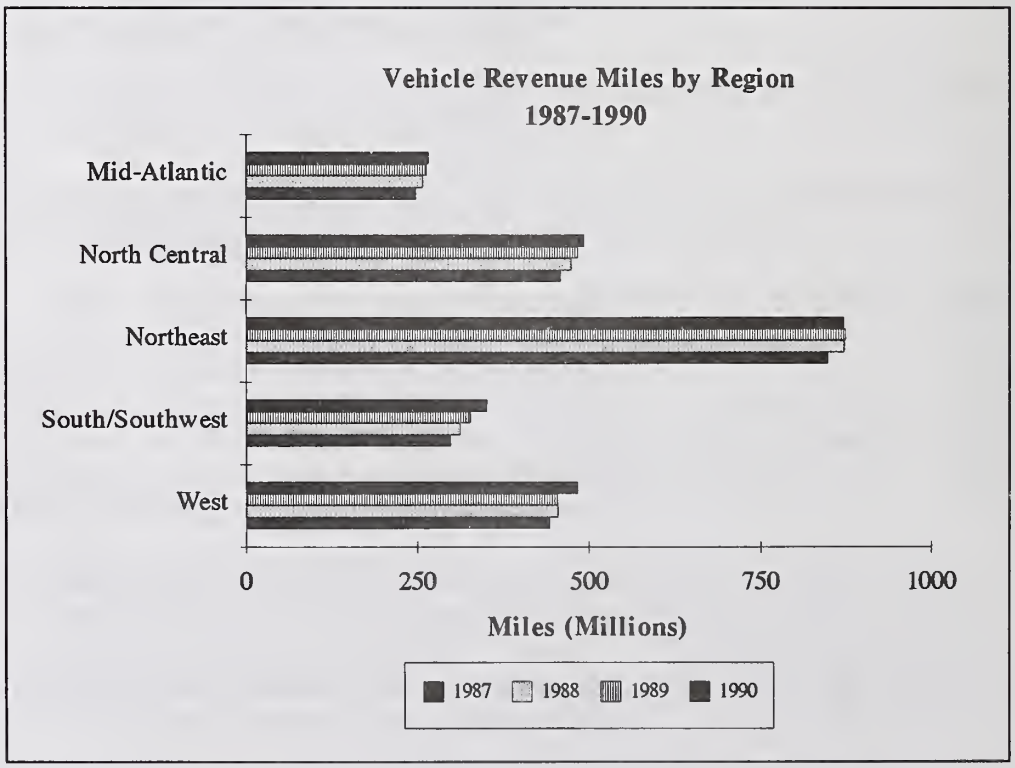
Region	Measures	
	Vehicle Revenue Miles (millions)	Average Vehicle Revenue Miles per Vehicle in Maximum Service (thousands)
Mid-Atlantic	266.7	34.0
North Central	492.9	33.6
Northeast	872.1	42.9
South/Southwest	351.6	35.8
West	483.5	38.7
Weighted Average	-	37.3
Total	2,466.8	-

Note: Slight deviations in totals may occur due to rounding.

Vehicle Revenue Miles by Region

The Mid-Atlantic region supplied about 267 million miles, or 11 percent of the 1990 service supplied to the nation. (Exhibit 53)

Exhibit 53



- The North Central region supplied about 493 million miles per year, or about 20 percent of all vehicle revenue miles.
- The Northeast lead the nation in miles of service supplied, with over 872 million miles in 1990, and 35 percent.
- The South-Southwest supplied almost 352 million miles, or 14 percent of national miles.
- The West supplied 483 million miles or almost 20 percent of the nation's transit service.

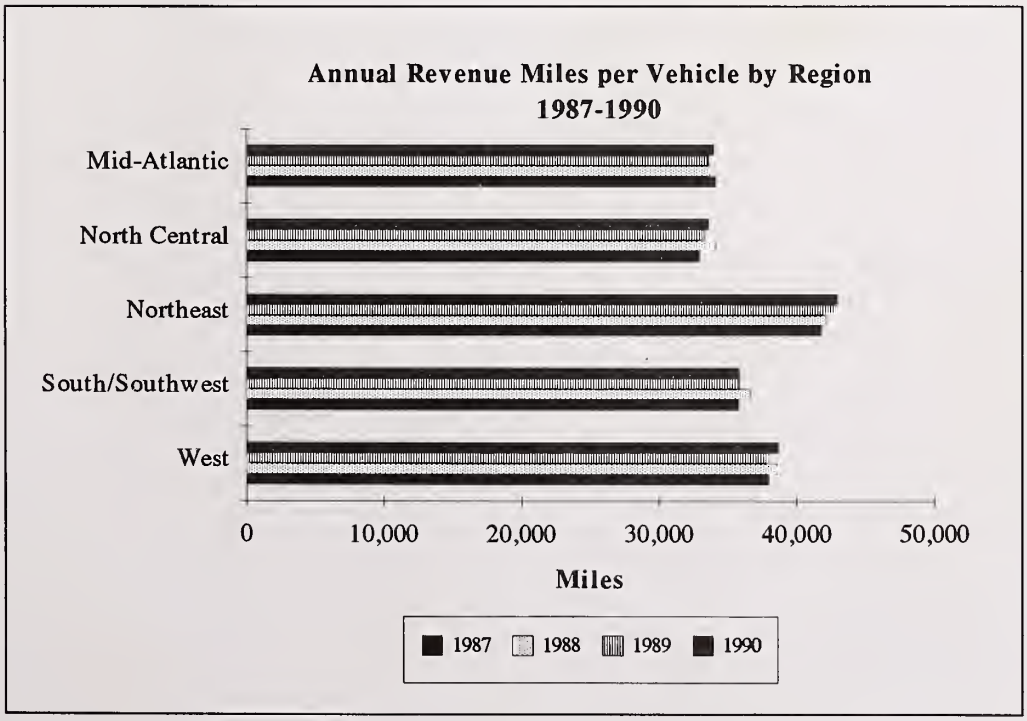
Annual Revenue Miles per Vehicle by Region

The Northeast compiled the largest number of annual miles on its vehicles of any of the regions. The average in 1990 was greater than 42,900 miles. The Northeast also had the greatest concentration of Heavy Rail, which averaged about 75 percent more miles per year than Bus. (See Exhibit 54)

- The West was second in utilization, with almost 38,700 miles per vehicle.
- The South-Southwest averaged over 35,800 miles per vehicle.
- The Mid-Atlantic achieved almost 34,000 miles per vehicle.
- The North Central region was very close to the Mid-Atlantic in this measure, and averaged almost 33,600 miles per vehicle.

The exhibit suggests wide variances among regions, and a high degree of consistency in this measure within each region.

Exhibit 54



Chapter 4

Operating Expenses

Introduction

The amount of service provided is a key determinant of operating expense, especially in terms of operator labor, fuel, and maintenance requirements. The type of service supplied (mode) also has significant bearing on the type of operating expense incurred.

This chapter explains many linkages between types and amounts of service and the various implications for operating expense. General trends in operating expenses are reviewed, and compared to changes in the Consumer Price Index (CPI).

The performance measures compare expenses to amounts of service supplied (such as operating expense per vehicle revenue mile). In this manner, service increases are factored into cost increases, providing a more equitable basis of evaluation. Comparisons to changes in the CPI are also included.

The performance measures also compare expenses to service consumed, which was discussed in Chapter 2, Service Consumption. Examples of such measures are operating expense per passenger mile or passenger trip.

The question of how much transit service costs is answered from the perspectives of cost components, such as object classes, and performance measures.

Chapter Organization

The review is divided into two main sections: an examination of total operating expenses and a review of performance measures related to operating expense. The section on performance measures follows the organizational style of prior chapters, with subsection discussions by mode, by fleet size, by UZA size, and by region.

Functions and Object Classes

In the first section, operating expenses are viewed within the two-dimensional matrix of function and object class. A function represents the activities associated with accomplishing a certain task, such as vehicle operations or maintenance. An object class is a grouping of expenses based on goods or services purchased. Examples are wages and salaries, materials and supplies, and purchased transportation. Operating expense functions and object classes are compared by mode and by size of urbanized area. Because transit is very labor intensive, the number of employees is also presented as a key expense input. Fuel consumption by size of bus fleet is reported in the expense section as an additional cost factor.

Functional categories are defined as the general operational areas that include:

- Vehicle Operations,
- Vehicle Maintenance,
- Non-Vehicle Maintenance, and
- General Administration.

Cost distribution by function is compared with employee distribution by function. The seven major object classes include:

- Labor,
- Fringe benefits,
- Services,
- Materials,
- Utilities,
- Purchased Transportation, and
- Miscellaneous.

The discussion and detailed exhibits focus on trends in labor, fringe benefits, and Purchased Transportation. Additional information is provided on diesel fuel usage.

Performance Measures

The second section introduces indicators of service efficiency and cost effectiveness such as:

- Operating cost per vehicle revenue mile,
- Operating cost per vehicle revenue hour,
- Operating cost per unlinked passenger trip,
- Operating cost per passenger mile, and
- Vehicle revenue hours per employee.

These measures are compared by mode. Selected measures are also compared by size of bus fleet, size of urbanized area, and region.

Related Measures

Service effectiveness measures, including passengers per vehicle revenue hour and passenger miles per vehicle revenue hour, were presented in Chapter 2, Service Consumption.

The common cost effectiveness measure, operating (passenger) revenue to operating cost, is related to reviews of funding sources in Chapter 5, Operating and Capital Funding.

Efficiency measures, such as vehicle revenue miles per maintenance employee and maintenance cost per vehicle revenue mile, are presented in the context of safety and maintenance in Chapter 6, Safety, Reliability, and Maintenance Effectiveness.

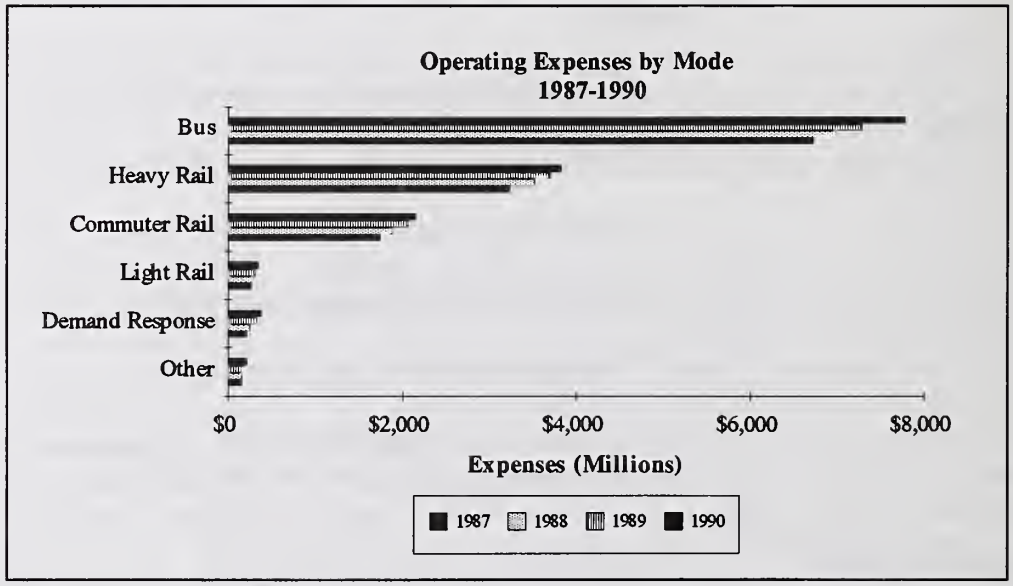
Total Operating Expenses

Operating Expenses by Mode

In Exhibit 55, Bus mode dominates in operating expenses, as it does in service supplied and service consumed.

- Fifty-three percent of the industry-wide operating expense was incurred in the provision of Bus services for 441 reporting systems (both Directly Operated and Purchased Transportation service).
- Forty-five transit systems provided primarily fixed-guideway systems (Light Rail, Heavy Rail and Commuter Rail). Together they represent 43 percent of the operating expenses for 1990.
- Demand Response, reported by 341 systems, represent three percent of the cost.
- Other, reported by 32 systems ranging from vanpools to ferryboats, represent one percent of cost.

Exhibit 55



(Any multi-modal systems above were counted for each mode they operate. Therefore, the sum of the systems above is greater than the total number of systems reporting.)

Between 1987 and 1990, total transit operating expenses increased by 19 percent, an average of six percent per year. These figures were not adjusted for inflation. Over the same period, the Consumers Price Index increased by almost 16 percent, an average of 5.1 percent per year. The number of systems reporting increased

from 463 to 518, a ten percent change. As noted in Chapter 3, total miles of service supplied increased by more than seven percent from 1987 to 1990. As expected, the growth in expenses occurred at different rates for each mode, related to the growth in service.

- Bus service experienced the least growth in cost, increasing 15.6 percent, an average of less than five percent per year. This increase accommodated inflation plus the two percent increase in miles of service noted in Chapter 3.

- Demand Response experienced the greatest growth at 79 percent, averaging about 22 percent per year. This growth is related to the 51 percent increase in service miles noted previously.

The total percentage changes since 1987 and the annual average changes in cost for the other modes are as follows:

- Heavy Rail experienced an 18 percent increase in cost, averaging 5.75 percent per year with a ten percent increase in service miles;

- Commuter Rail experienced a 23 percent increase in cost, averaging 7.25 percent per year with a 14 percent increase in service miles; and

- Light Rail experienced a 28 percent increase in cost, averaging 8.5 percent per year with a 12 percent increase in service miles.

Distribution of Operating Expense by Function

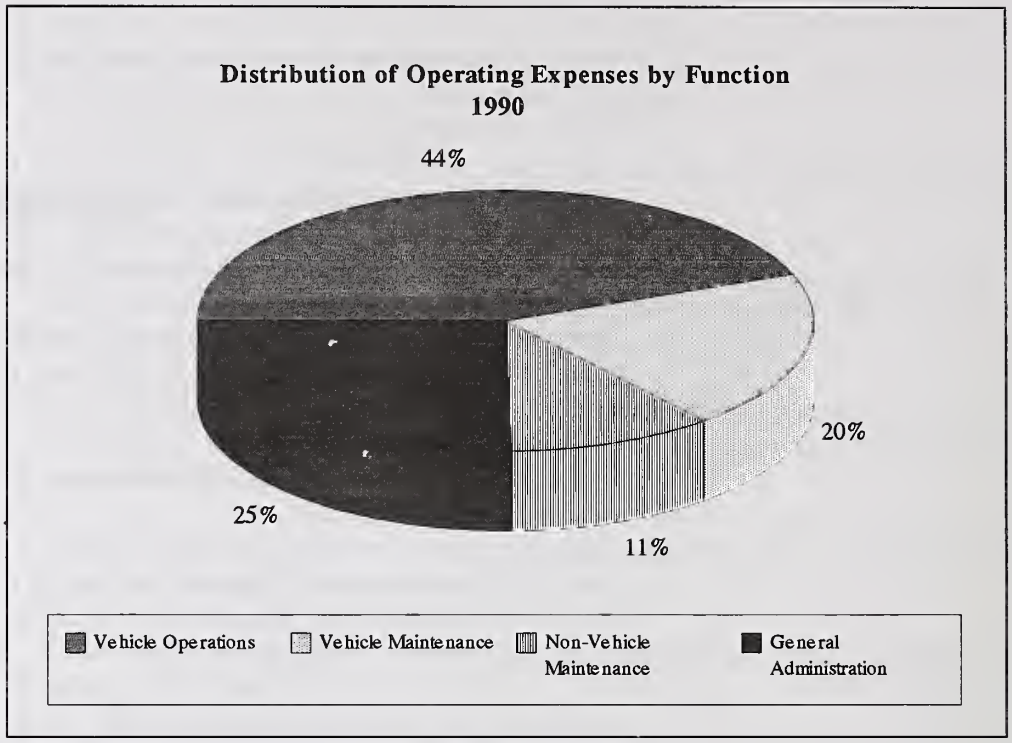
The operating expenditure for reporting transit systems was $14.8 billion in 1990. The comparable figure for 1987 is $12.4 billion. This represents an increase of 19 percent, or about six percent per year. This increase was not adjusted for the impact of service increases or inflation (Exhibit 56).

- Vehicle Operations includes transportation administration, movement control, scheduling, and direct operations. It is the most labor-intensive function of the industry and represents the largest portion of expenses (44 percent).

- Vehicle Maintenance represents 20 percent of expenses. Vehicle Maintenance includes inspection, maintenance, cleaning, fueling, and repairing revenue and non-revenue ("service") vehicles. Labor and materials are typically the key expenses in this area.

- Non-Vehicle Maintenance represents 11 percent of expenses. Non-vehicle maintenance includes all activities associated with facility maintenance, such as maintenance of control systems and equipment, structures, tunnels and subways, roadway and track, passenger stations, and administration facilities and grounds. This function is typically much more significant in fixed guideway modes than in non-fixed guideway modes.

Exhibit 56



- General Administration represents 25 percent of expenses. General Administration includes activities such as system security, safety, personnel administration, legal services, insurance, data processing, marketing, customer service, and planning.

Operating Expenses by Function and Mode

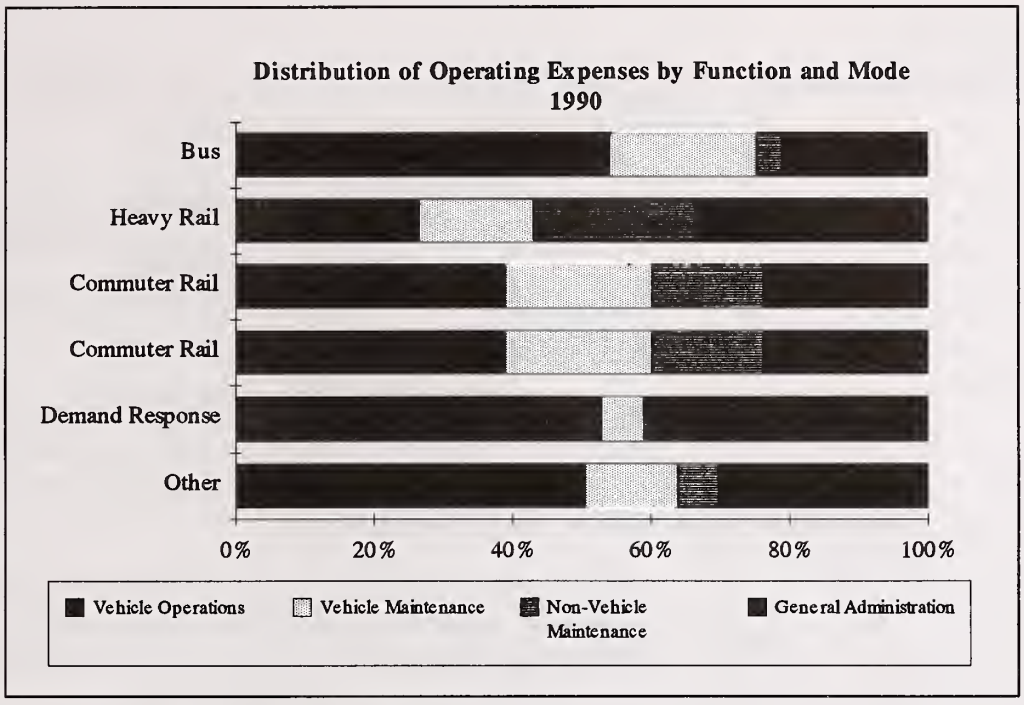
Exhibits 57 and 58 show that the distribution of expenses across functional categories varies by mode. Much of the difference between modes depends on the nature of the vehicle technology and type of operations. Fixed guideway systems such as Commuter Rail and Heavy Rail must maintain their fixed guideway in a state of good repair. Modes such as Bus and Demand Response rely primarily on streets that are maintained by others.

- Modes that must maintain fixed guideway experienced relatively high amounts of Non-Vehicle Maintenance expense. Non-Vehicle Maintenance consumed 23 percent of Heavy Rail expense, 16 percent of Commuter Rail expense, and 14 percent of Light Rail expense.

- Demand Response services, which have no fixed route and are usually operated under contract to other providers, had low maintenance expense. Non-Vehicle Maintenance required only one percent of all expense, while Vehicle Maintenance required an average of six percent.

- A high proportion (40 percent) of Demand Response expense was consumed in the administrative function. This is due in part to the individualized scheduling requirements for this type of service. It also reflects the option of reporting

Exhibit 57



Purchased Transportation under the category of General Administration within the Section 15 system.

- Heavy Rail also showed a high proportion (34 percent) of administrative expense. This is explained in part because ticketing and security costs are included in this category. These expenses are more significant in rail modes than in other modes.

For each mode category (except Commuter Rail), no significant variation in shares of total expenditure by function was observed between 1987 and 1990.

- The Commuter Rail function of Vehicle Operations climbed steadily from 33 percent to 39.0 percent of expense. Corresponding declines in Non-Vehicle Maintenance (from 19 to 16 percent), and administration (from 25 to 24 percent) were recorded. It should be noted that this trend represents a statistical base of only 20 reporters, and changes for a single reporter are therefore magnified.

Exhibit 58

Operating Expenses by Mode and Function
(millions)
1990

Mode	Function				
	Vehicle Operations	Vehicle Maintenance	Non-Vehicle Maintenance	General Administration	Total
Bus	$4,211.6	$1,650.7	$289.9	$1,636.5	$7,788.62
Heavy Rail	1,015.9	634.3	893.4	1,281.4	3,825.0
Commuter Rail	841.4	457.3	346.3	511.8	2,156.8
Light Rail	152.8	79.7	47.8	64.3	344.6
Demand Response	204.1	23.1	2.6	155.7	385.5
Other	108.1	28.7	12.5	64.8	214.1
Total	$6,533.9	$2,873.8	$1,592.5	$3,714.4	$14,714.6

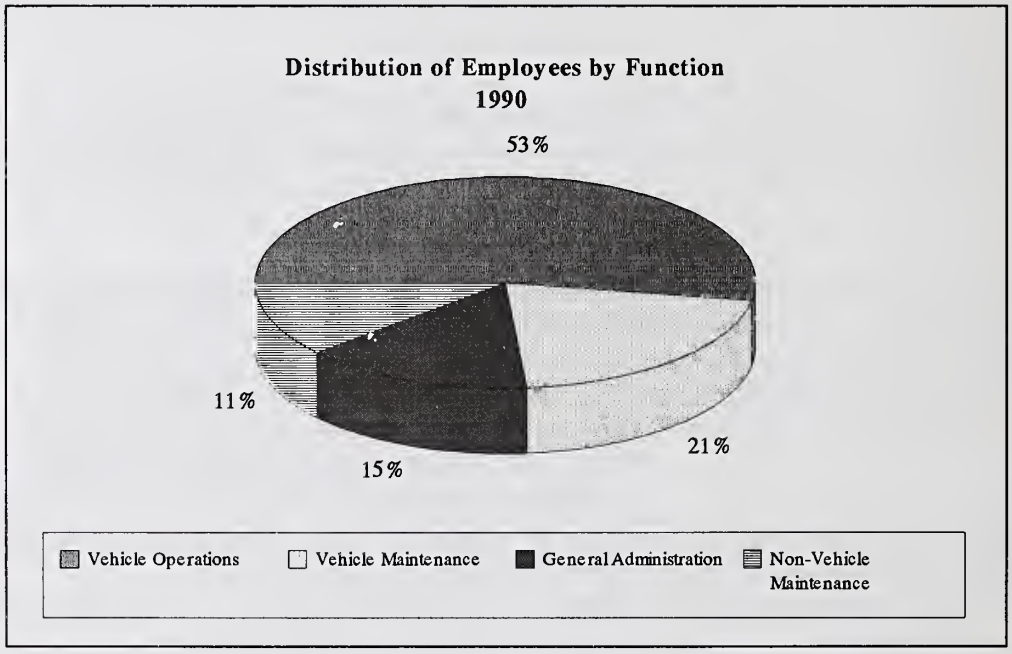
Note: Slight deviations in totals may occur due to rounding.

Distribution of Employees by Function

As shown in Exhibit 59, the functional distribution of employees does not completely parallel that of operating expense.

- Vehicle Operations, the most labor-intensive function of the transit industry, was responsible for 44 percent of expense, and 53 percent of employees.
- Vehicle Maintenance was responsible for almost 20 percent of expense, and 21 percent of employees.
- Non-Vehicle Maintenance was responsible for 11 percent of expense and 11 percent of employees. Many large transit systems sub-contract for significant portions of non-vehicle maintenance expense, such as escalator and elevator maintenance services.
- General Administration claimed 25 percent of expense, and 15 percent of employees. Advertising, promotions, legal services, and insurance represent some of the major items that increase the non-labor aspects of this function.

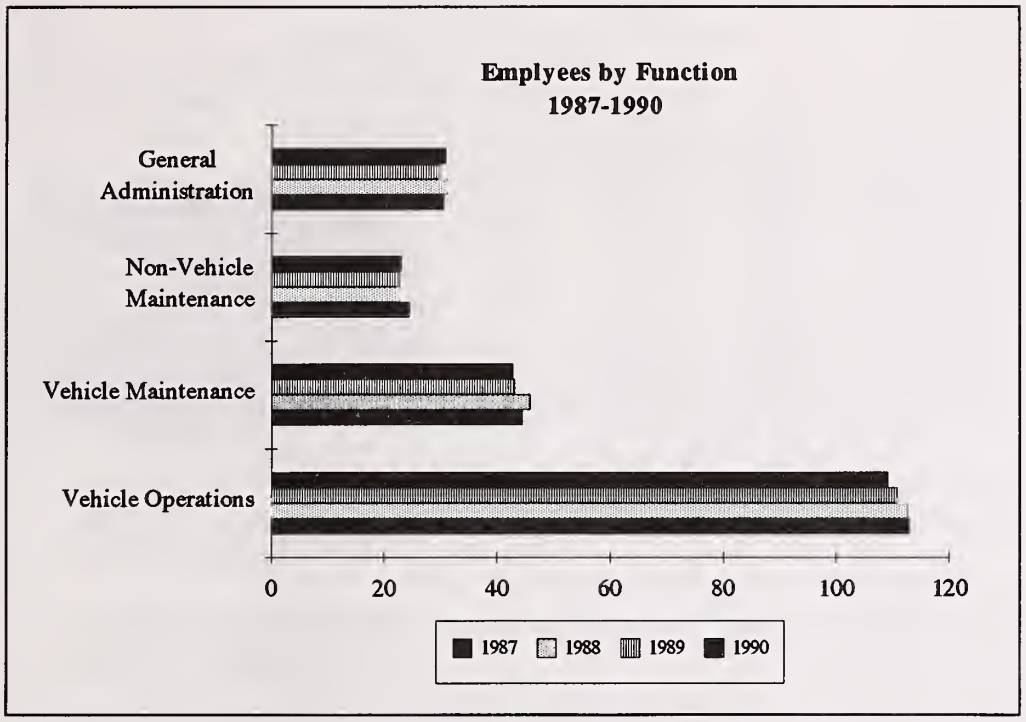
Exhibit 59



Employees by Function

Since 1987, the number of employees declined despite the service increases noted above. Total employees reported for 1990 (Exhibit 60) were 205,863, a drop of three percent from 1987. This decrease may be related to increases in Purchased Transportation, as these services are not included in employee counts within the Section 15 system. It may also reflect increasing numbers of part-time employees, which can increase a transit system's ability to efficiently cover peak service.

Exhibit 60



However, this theory cannot be confirmed because part-time employee information was not collected through Section 15 reporting. The change in employee levels has not been consistent across all functions.

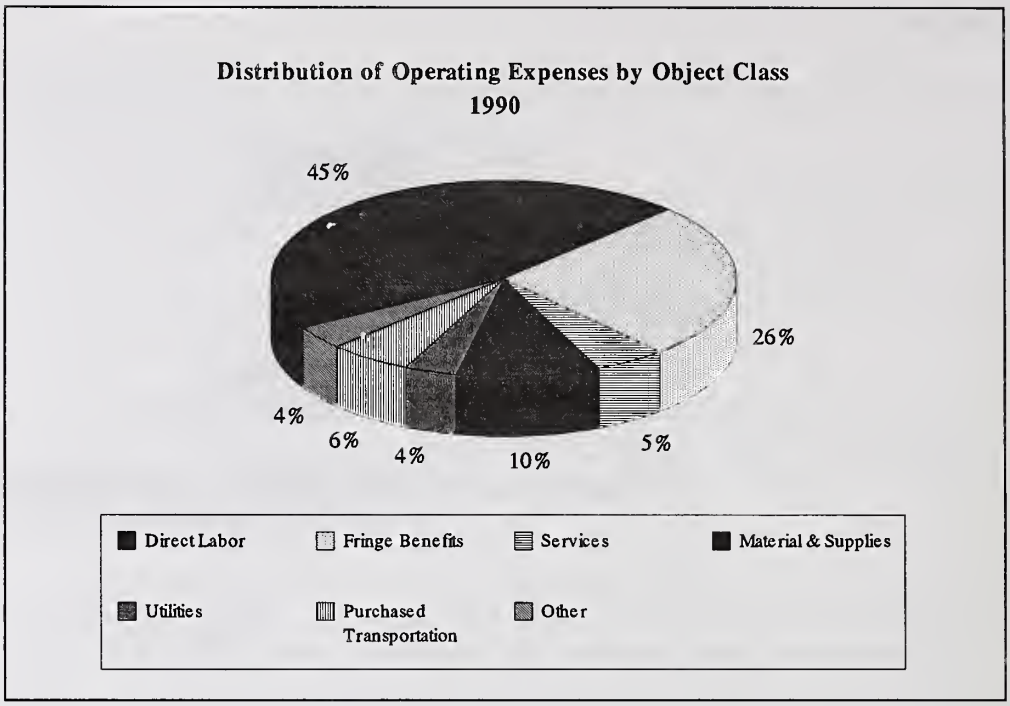
- Vehicle Operations employees declined by three percent.
- Vehicle Maintenance employees decreased by three percent.
- Non-Vehicle Maintenance employees decreased by six percent.
- General Administration employees increased by one percent.

Distribution of Operating Expenses by Object Class

In Exhibit 61, labor and fringe benefits together were the largest 1990 transit system operating expenses, representing about 72 percent of total expenses, the same percentage as 1987.

- The category of Services includes professional and technical services, such as legal and audit fees, and contract services, such as grounds maintenance or security. Services consumed over 4.5 percent of operating expenses.
- Object class Material and Supplies includes diesel fuel, general maintenance repair parts, oil and lubricants, tires and miscellaneous materials, and supplies. Materials and supplies consumed over ten percent of all operating expenses.

Exhibit 61



- Utilities include propulsion power for electrically powered rail systems plus general building and station utilities. Utilities consumed about four percent of operating expenses.

- Purchased Transportation represents six percent of expenses. The comparable 1987 figure was five percent.

- The category Other includes casualty and liability expense (self-insurance costs and premiums), plus miscellaneous items such as travel or dues. Other expenses consumed less than four percent of total operating expense.

Operating Expenses by Object Class and Function

Exhibit 62 presents the matrix relationship between functions and object classes. It also serves as a transition from the previous discussion by function to the discussion by object class that follows.

- The Vehicle Operations function is dominated by labor and fringe benefit expenses, which consumed about 78 percent of total costs. Materials and Supplies, combined with utilities, which primarily includes diesel fuel and propulsion power, consumed another 11 percent of cost. Purchased Transportation was responsible for about six percent of Vehicle Operations expense. Services and Other expenses were responsible for five percent of Vehicle Operations.

Exhibit 62

Operating Expenses by Object Class and Function
(millions)
1990

Object Class	Function				
	Vehicle Operations	Vehicle Maintenance	Non-Vehicle Maintenance	General Administration	Total
Direct Labor	$3,338.2	$1,357.4	$852.4	$1,236.5	$6,784.5
Fringe Benefits	1,751.6	757.1	505.9	776.9	3,791.4
Materials & Supplies	500.5	666.5	189.4	115.7	1,472.1
Purchased Transportation	397.9	9.2	1.8	476.1	884.9
Services	45.2	96.0	142.8	422.3	706.3
Utilities	208.9	9.6	173.4	139.7	531.6
Other	291.6	-21.7	-273.2	547.1	543.8
Total	$6,533.9	$2,874.0	$1,592.5	$3,714.2	$14,714.6

Note: Slight deviations in totals may occur due to rounding.

- Vehicle Maintenance is also labor intensive. Labor and fringe benefits was responsible for 74 percent of Vehicle Maintenance expense. Materials and supplies consumed another 23 percent.

- The Non-Vehicle Maintenance function expended 85 percent of its funds on labor and fringe benefits.

- The General Administration function consumed 54 percent of its expense in labor and fringes. Services and Other expenses, such as insurance and marketing, consumed a full 26 percent. Purchased Transportation was responsible for almost 13 percent of all General Administration expense.

Distribution of Operating Expenses by Mode and Object Class

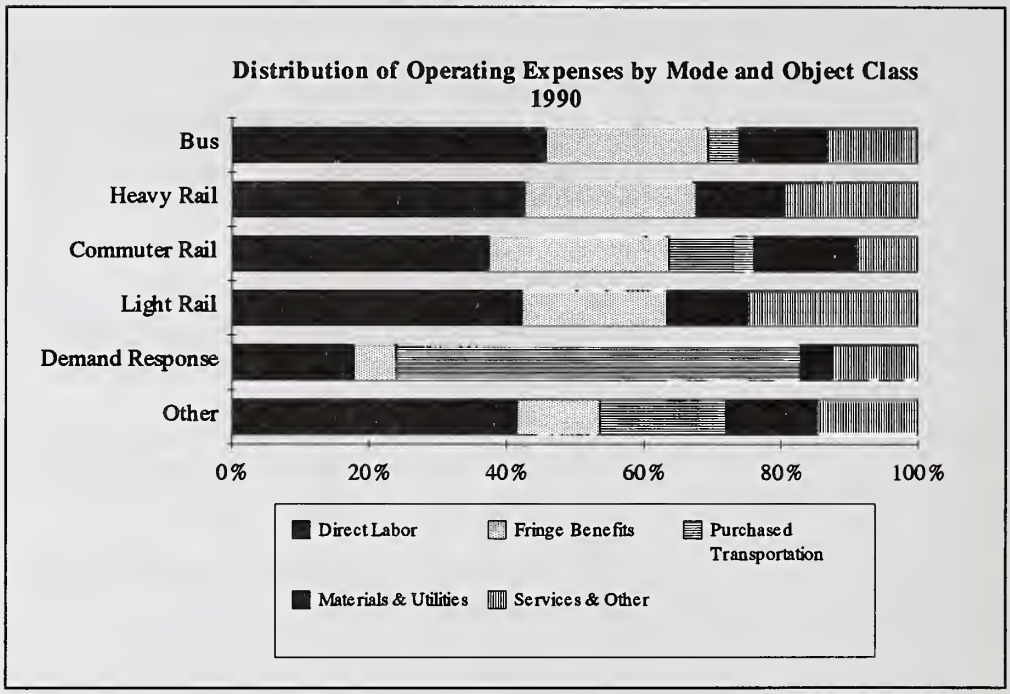
The percentage of operating expense by mode and object class is provided in Exhibit 63. Direct Labor accounts for the largest percentage of total operating expense, or 46.1 percent for all modes. An exception is found within the Demand Response mode which utilizes more purchased transportation to provide service. Purchased transportation includes wages paid for contract drivers.

- Direct labor was 46 percent of Bus Operating Expenses with Fringe Benefits accounting for 24 percent. In addition, Purchased Transportation, which includes contract driver wages, represents an additional five percent. Together, the three object classes comprise 70 percent of Total Bus Operating Expense. These percentages are representative of the higher levels of labor participation in the bus mode compared to others.

- For Heavy Rail, Direct Labor was 43 percent and Fringe Benefits was 25 percent of Total Modal Operating Expense. A major difference in this mode, compared to Bus, is that there was no Purchased Transportation. There was a heavier reliance, of 19 percent, on Services and Other than with Bus.

- Light Rail had a distribution similar to Heavy Rail, but with a higher concentration in Services and Other, which was 25 percent of Total Mode Operating Expense. Direct Labor and Fringe Benefits combined constituted 63 percent of Total Mode Operating Expense.

Exhibit 63



- Commuter Rail expended less on Direct Labor than the other rail modes, 37 percent. However, its Fringe Benefits total was 26 percent, the highest of all modes. Purchased Transportation had a significant percentage, 12 percent, of Total Mode Operating Expense.

- Demand Response had the largest percentage of Total Mode Operating Expense for Purchased Transportation at 59 percent. The predominance of this object class within this mode is an indicator of a heavy reliance on contract driver wages.

Operating Expenses by Mode and Object Class

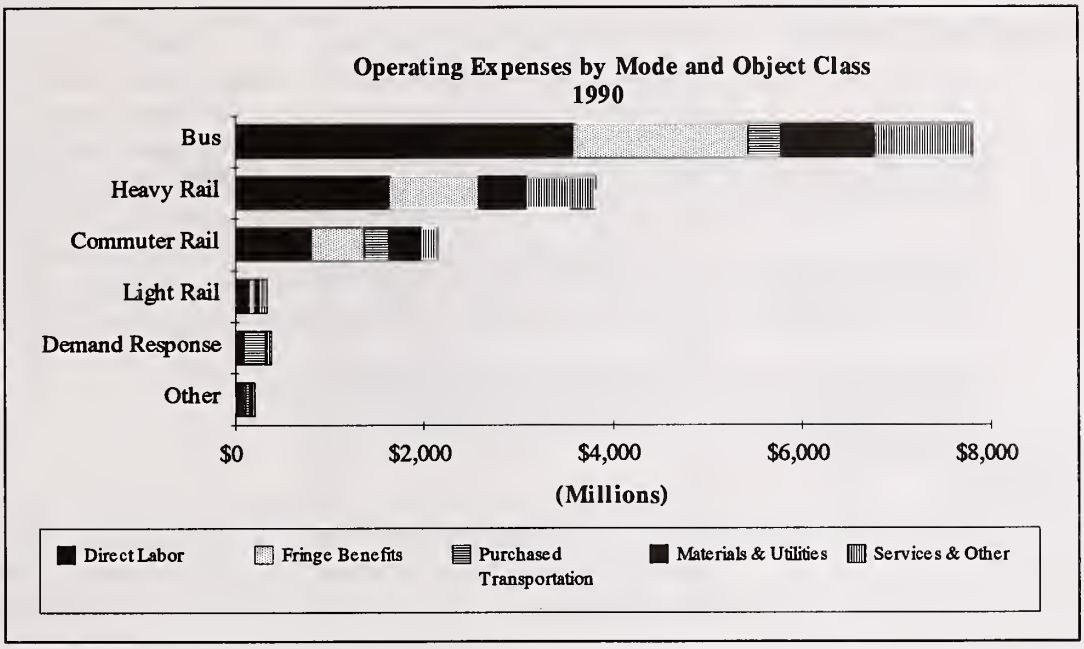
Labor and fringe benefits generally made up 63 to 69 percent of operating expense, depending on the mode. (Exhibits 64 and 65)

- Demand Response service was the major exception to this rule. Purchased Transportation comprised 59 percent of the expense for the Demand Response mode. Purchased Transportation included wages for contract drivers. Direct employee labor and fringes accounted for 24 percent of the expense.

- The group of Other modes averaged 54 percent of expense on wages and fringes, and 18 percent on Purchased Transportation.

- Purchased Transportation also played a significant role in Commuter Rail, at 12 percent of expense. Purchased Transportation made up a lesser part of Bus service, at 4 percent of cost.

Exhibit 64



- Materials and Supplies combined with utilities claimed 12 to 15 percent of the expenses of each major mode, except for Demand Response service.

- The object class Materials and Supplies, which includes diesel fuel, claimed 12 percent of Bus expense. Materials and Supplies claimed nine percent of Commuter Rail expense (which in some cases uses fuel). This object class claimed six percent each of Light Rail and Heavy Rail expense.

- Utilities, which include propulsion power, claimed one percent of Bus, seven percent of Heavy Rail, six percent of Light Rail, and six percent of Commuter Rail expense.

Exhibit 65

Operating Expenses by Mode and Object Class
(millions)
1990

Mode	Object Classes							
	Direct Labor	Fringe Benefits	Materials & Supplies	Purchased Transportation	Utilities	Services	Other	Total
Bus	$3,562.5	$1,836.9	$908.9	$354.0	$75.2	$280.9	$770.3*	$7,788.6
Heavy Rail	1,627.7	957.7	221.8	0	273.1	129.7	615.0*	3,825.0
Commuter Rail	806.1	566.7	199.6	265.7	123.9	96.4	98.4*	2,156.8
Light Rail	145.4	73.0	19.6	0	20.6	11.0	75.0*	344.6
Demand Response	68.7	24.0	16.6	226	1.5	12.9	35.8*	385.5
Other	88.9	26.0	24.2	39.3	4.0	9.0	22.9*	214.3
Total by Mode and Object Class	$6,299.2	$3,484.3	$1,390.7	$884.9	$498.2	$539.9	$1,617.4	$14,714.6
Joint Expenses	+485.3	+307.1	+81.4	0	+33.4	+166.4	-1073.6	0
Total by Object Class	$6,784.5	$3,791.4	$1,472.1	$884.9	$531.6	$706.3	$543.8	$14,714.6

* Includes joint expenses not directly allocated to individual object classes by mode.
Note: Slight deviations in totals may occur due to rounding.

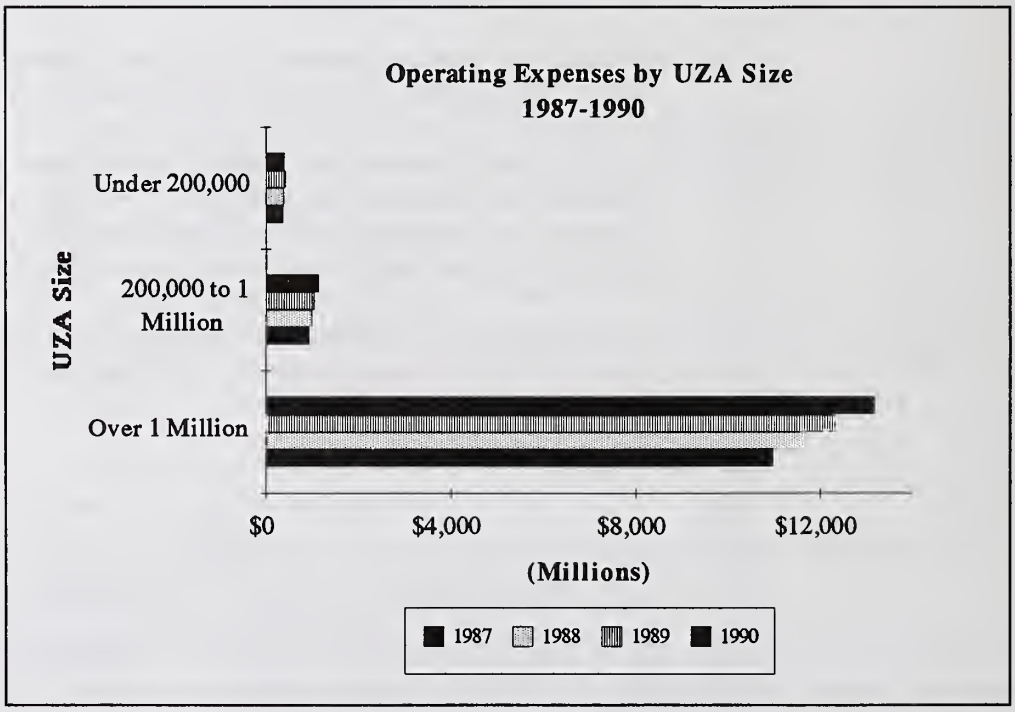
Detail on Allocation of Joint Modal Expenses

Joint modal expenses are items that pertain to all modes, and are not easily chargeable to a single mode. The transit system collects them by object class, and then allocates a lump sum amount to each mode based on an appropriate formula. Exhibits 63, 64, and 65 include all joint mode expenses in Object Class Other. This overstates the Other category and understates all remaining categories. However, it presents appropriate totals for each mode. The table, Exhibit 65, presents the detail on operating expense by object class and mode. It also includes the detail on joint expense by object class (bottom two rows of the table). This reconciles Exhibits 63, 64, and 65 to other tables and graphs that present different percentages and values by object class.

Operating Expenses by UZA Size

Exhibit 66 depicts the total expenditures by UZA size. Expenses follow the patterns established earlier in service supplied and service consumed. UZAs of one million and more dominated the transit industry, with almost 90 percent of total expenditures. This proportion has been stable since 1987.

Exhibit 66

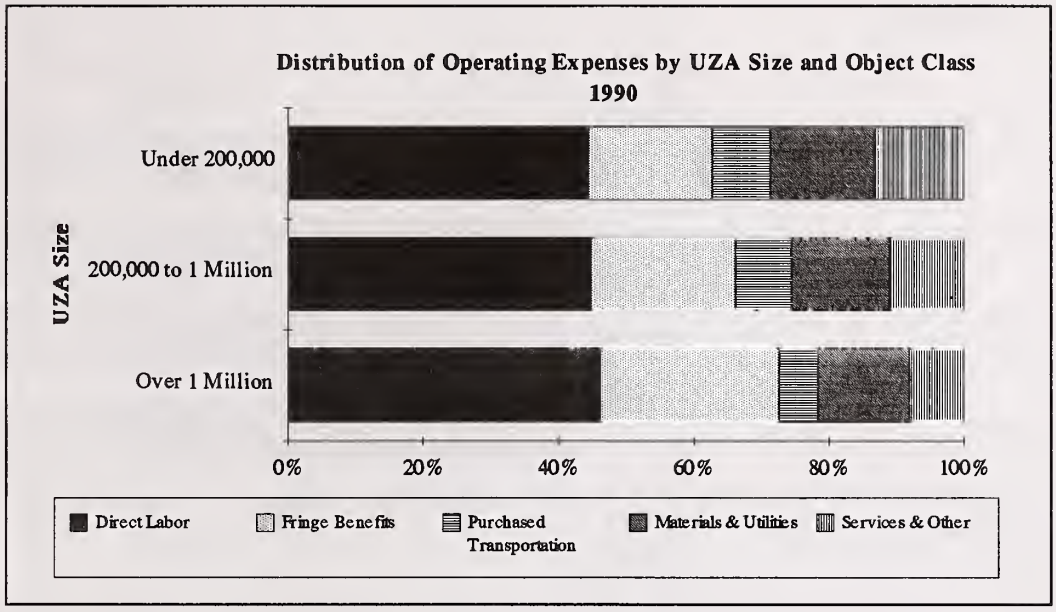


Distribution of Operating Expenses by UZA Size and Object Class

Exhibit 67 reveals that the patterns of spending by UZA size are similar, despite size and mode differences.

All three population groups averaged about 44 to 46 cents of every dollar on Direct Labor.

Exhibit 67



- Fringe Benefits added 18 cents to the labor cost out of every dollar for small UZAs. Fringes added 21 cents for medium UZAs, and 26 cents for large UZAs.

- Utilities, Materials and Supplies combined added an additional 14 cents for small UZAs, 11 cents for medium UZAs, and eight cents for large UZAs.

- Purchased Transportation added almost nine cents for small UZAs, more than eight cents for medium UZAs, and almost six cents for large UZAs.

Trends in Key Object Classes

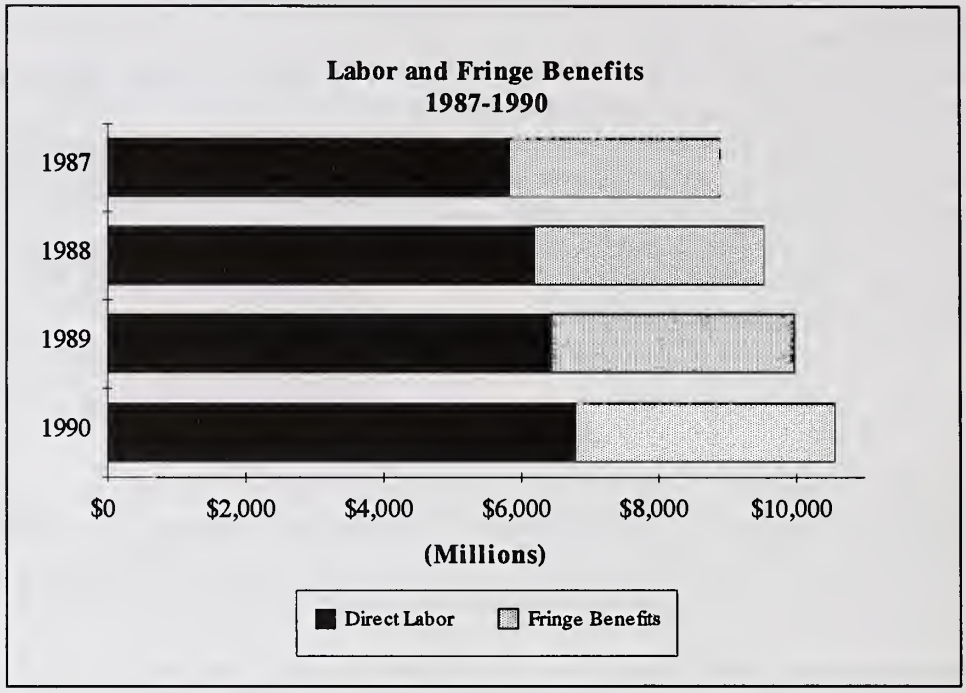
No significant changes took place in total spending patterns between 1987 and 1990. Every object class preserved its position in the general ranking of expenses. Further, every object class maintained the same basic percentage share of expenses over the four year period. No object class shifted by more than one percentage point during the period; however, significant changes occurred within individual modes.

Labor and Fringe Benefits

Exhibit 68 shows that over the four year period, Direct Labor for all modes increased from $5.8 billion to $6.8 billion. This represents a 16 percent change, averaging five percent per year. Fringe Benefits increased by 23 percent over the same period, averaging 7.25 percent per year.

Fringe Benefits comprised 36 percent of total labor expense in 1990, compared to 34 percent in 1987.

Exhibit 68



Purchased Transportation Expense by Mode

In Exhibit 69, Purchased Transportation showed the greatest percentage increase in expense of any object class from 1987 to 1990. Expenditures for Purchased Transportation increased by 45 percent over the four year period. Purchased Transportation claimed six percent of every transit dollar in 1990, compared to five percent in 1987.

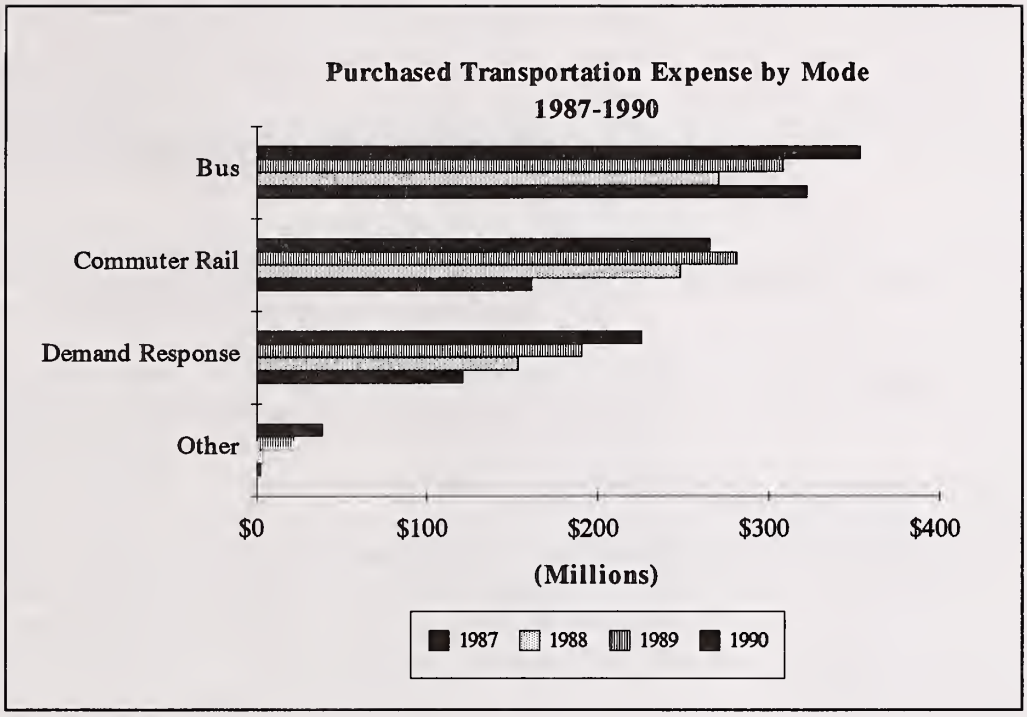
The different modes employed Purchased Transportation in very different patterns. In general, however, there was an increase in the practice of purchasing transportation services from public agencies* or private providers.

* When a public agency purchases service from another public agency.

- Commuter Rail experienced rapid growth in its Purchased Transportation, going from $162 million to $266 million. This represents a 64 percent increase, which indicates that Purchased Transportation increased from a nine to a 12 percent share of all expenses. Transit systems are sometimes able to meet long distance, heavy volume travel demands by contracting with an existing rail operator on a well-placed rail line.

Twenty-six percent of all Purchased Transportation expense was for Demand Response service. Fifty-nine percent of all Demand Response expense went to Purchased Transportation, which increased from $121 million and 56 percent of all Demand Response expenses in 1987, to $226 million and 59 percent of expenses in 1990.

Exhibit 69



- This represents an 87 percent cost increase in four years, averaging roughly 17 percent per year. Purchased Transportation Demand Response miles of service increased 41 percent over the same period.

- Non-Purchased Transportation Demand Response expense increased 71 percent between 1987 and 1990. Directly operated demand response miles of service increased by 72 percent during the same period.

- The increase in Purchased Transportation expense, relative to the amount of service, was greater than the increase for directly operated service. This signifies that Purchased Transportation service increases were more expensive than Directly Operated service increases.

Energy Consumption by Type and Size of Bus Fleet

Fuel consumption is a factor of vehicle speed, traffic congestion, climate, geography, vehicle age and maintenance practices. (Exhibit 70)

- Buses of all sizes relied on diesel fuel for over 99 percent of their energy needs.

- Liquid natural gas was the source of 0.51 percent of all gallons consumed in the motor bus mode. Gasoline powered some buses, using 0.34 percent of all gallons.

Exhibit 70

Energy Consumption by Type and Size of Bus Fleet
(gallons in thousands)
1990

Number of Buses	Energy Consumed (gallons)				
	Diesel Fuel	Gasoline	LPG or LNG	Bunker Fuel	Total
Under 25	17,807	492	23	2	18,324
25-99	55,446	925	0	0	56,370
100-249	85,193	168	1,214	88	86,663
250 and Over	314,422	19	2	0	314,443
Total	472,867	1,604	1,239	91	475,801

Note: Slight deviations in totals may occur due to rounding.

When considering all modes, including Demand Response, annual diesel fuel use increased to 545 million gallons per year. Diesel's share of the transit energy market dropped slightly to 98.1 percent (excluding electricity). The 1990 figure represents a 2.3 percent decline from the 1987 level of 558 million gallons.

When all modes are considered, gasoline usage climbed from 1.6 to 7.9 million gallons. Gasoline claimed 1.4 percent of the market, primarily for Demand Response vehicles. The 7.9 million gallons represent a 23 percent increase over the 1987 value.

Performance Measures

Section 15 reporting requirements contribute to a very extensive database of information. Many measurements of transit performance can be derived from this information, for individual transit systems and for the nation as a whole. However, the various measurements and ratios developed in the *National Transit Summaries and Trends*, or even for an individual system, should not be considered in isolation.

Performance measures are generally divided into three main categories: efficiency, effectiveness, and impact measures. Impact measures, such as achievement of social, environmental, and energy conservation objectives, are not amenable to evaluation within the framework of the Section 15 database. Therefore, efficiency and effectiveness measures are the focus of *National Transit Summaries and Trends.*

Efficiency measures compare the inputs, such as dollars or labor, to the outputs produced, such as miles or hours of service. Cost effectiveness measures compare the inputs (dollars or labor) to the end product, which is the service to the public (measured in the number of passenger trips or passenger miles). Service effectiveness measures compare the end product (passenger trips or passenger miles) to the service outputs (miles or hours of service).

Service effectiveness was reviewed in Chapter 2 in the context of service consumption. The remainder of this chapter includes both efficiency measures and cost effectiveness measures.

Performance Measures by Mode

Cost or service efficiency, which is discussed first, is only one parameter for evaluation. The strength of service efficiency measures is that they objectively compare two factors that are essentially determined by the transit system: levels of service and cost of service. However, the weakness is that they do not measure how the service is used. This section includes both service efficiency and cost effectiveness measures.

Related Measures

Measures of how the service is used are called service effectiveness measures and cost effectiveness measures.

Service effectiveness measures (unlinked passenger trips per vehicle mile, etc.) were reviewed in Chapter 2, Service Consumption.

Cost effectiveness measures such as operating expense per unlinked passenger trip and operating expense per passenger mile immediately follow the information on service efficiency within each subsection. As in earlier chapters, the subsections evaluate measures by Mode, by size of bus fleet, by UZA size, and by region.

Cost effectiveness measures such as operating revenue to operating cost are examined in Chapter 5, Operating and Capital Funding.

Selected Performance Measures by Mode

Exhibit 71 provides an overview of the efficiency and effectiveness measures by mode that follow. The changes in rankings are significant. For example, Demand Response was the least expensive mode in cost efficiency measures (Cost per Mile and Cost per Hour), but was the most expensive mode in cost effectiveness measures (Cost per Unlinked Passenger Trip and Cost per Passenger Mile). Conversely, Commuter Rail was the most expensive mode in cost efficiency measures, but was the least expensive in cost effectiveness.

Exhibit 71

Selected Performance Measures by Mode
1990

Mode	Measures				
	Cost per Vehicle Revenue Mile	Cost per Vehicle Revenue Hour	Vehicle Revenue Hours Per Employee	Cost per Unlinked Passenger Trip	Cost per Passenger Mile
Bus	$ 5.12	$ 64.98	915	$1.59	$ .43
Heavy Rail	$ 7.34	$145.65	570	$1.63	$ .33
Commuter Rail	$10.67	$341.20	288	$6.27	$ .29
Light Rail	$ 9.51	$ 98.96	593	$1.15	$ .45
Demand Response	$ 2.06	$ 26.68	1,240	$8.89	$1.37
Weighted Average	$5.97	$ 87.12	821	$1.85	$ .39

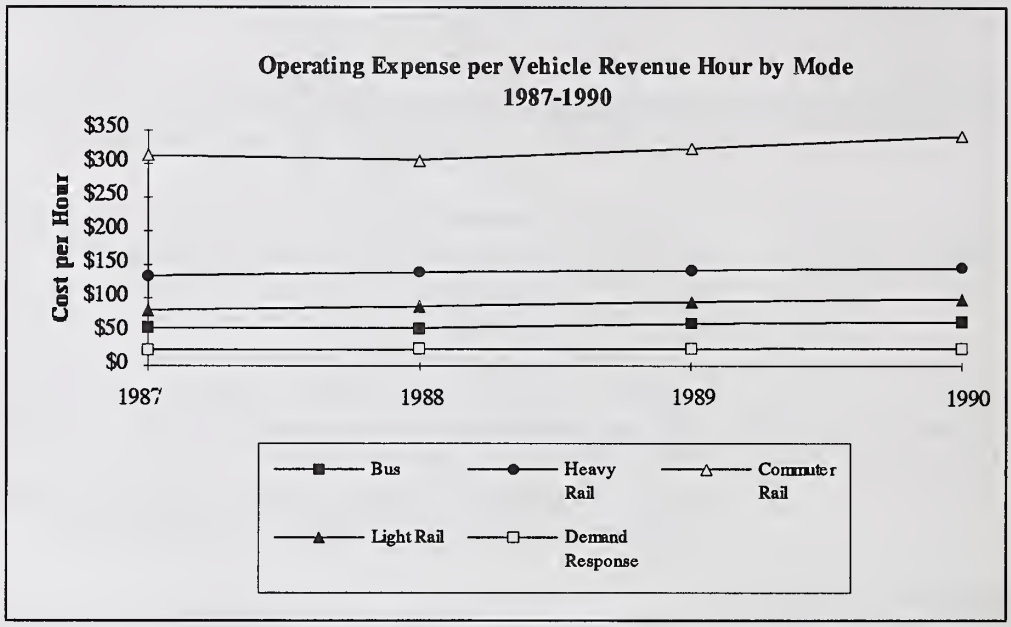
Note: Slight deviations in totals may occur due to rounding.

Service Efficiency: Operating Expense Per Vehicle Revenue Hour by Mode

Most Vehicle Operation costs are determined by the hours of operation, without regard to the miles traveled. Cost per hour compares hours of service supplied to

cost of operating that service, irrespective of the speed of service. From 1987 to 1990, the increase in transit costs per hour has averaged less than the rate of inflation. (Exhibit 72)

Exhibit 72



- Bus service cost about $65 an hour in 1990. This represents an increase of 13.6 percent over the 1987 level, averaging about 4.25 percent per year. This is less than the increase in the Consumer's Price Index-Urban consumers (CPI-U). The CPI-U increased by 15.9 percent from December 1987 to December 1990, averaging more than five percent per year.

- Heavy Rail averaged $146 per hour. This is more than double the cost of Bus service. The 1990 cost represents an increase of 9.4 percent since 1987, averaging about three percent per year.

- All other modes were inexpensive compared to Commuter Rail, which averaged $341 an hour. Commuter Rail was also effective at containing costs. The 1990 cost represents an increase of 9.3 percent since 1987, similar to Heavy Rail, averaging about three percent per year.

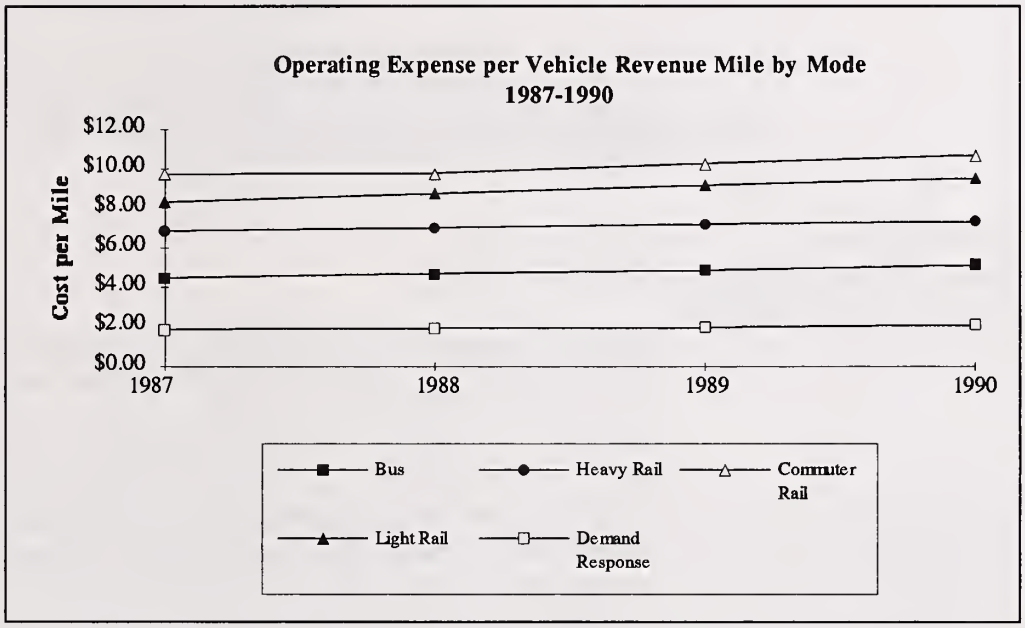
- Light Rail averaged $99 per hour. This represents a 20.6 percent increase over 1987, or less than 6.5 percent per year. Light Rail was the only mode whose increases exceed the rate of change of the CPI.

- Demand Response service cost an average of $27 per vehicle revenue hour. Demand Response was the least expensive mode based on cost effectiveness. The increase since 1987 was 13.2 percent, averaging less than 4.25 percent per year.

Service Efficiency: Operating Expense per Vehicle Revenue Mile by Mode

Cost per mile measures the cost of service supplied from the perspective of distance traveled rather than time consumed in travel. (Exhibit 73) The average cost per mile, across all modes, was $5.31 in 1987 and $5.94 in 1990. Cost per revenue mile increased less than 12 percent since 1987, averaging about four percent per year. This is less than the rate of inflation.

Exhibit 73



- Bus service cost about $5.12 per mile in 1990. Bus cost per mile increased about 15 percent since 1987, an average of less than five percent per year.

- Heavy Rail averaged $7.34 a mile. Heavy Rail cost per mile increased by less than eight percent since 1987, averaging 2.5 percent per year.

- Commuter Rail averaged $10.67 a mile. Commuter Rail cost per mile increased less than ten percent since 1987, averaging about three percent per year.

- Light Rail averaged $9.51 per mile. Light Rail cost per mile experienced a 14 percent increase over four years, or an average of 4.5 percent per year. This is less than the increase in the CPI. Cost per hour increased more than cost per mile. Therefore, miles increased faster than hours, indicating an increase in average speed.

- Demand Response service averaged $2.06 a mile. Demand Response cost per mile increased by less than 12 percent, or less than four percent per year.

The comparison between Exhibit 73 and Exhibit 72 points out the difficulty in relying on any one measure, or set of measures, in an evaluation of service. The different speeds of the various modes radically change the relative values.

- Heavy Rail averaged 23 percent less in cost per mile than Light Rail, although it was almost 50 percent more costly per hour.

- Commuter Rail service was a little more than twice the cost of Bus service on a per mile basis. Comparing the cost per hour, it was more than five times as expensive.

Expenses such as Vehicle Operations are primarily associated with the hours of service supplied. However, the miles of service supplied, and the speed of that service, may hold greater value for the transit rider. Which measure is preferable depends upon the perspective of the user.

Labor Efficiency: Vehicle Revenue Hours per Employee by Mode

Exhibit 74 suggests the labor intensity of the various modes, and the efficient use of labor resources. Increases in vehicle revenue hours per employee represent an improvement in efficiency. Assuming 2,080 hours per employee annually, this information can also be converted to show how many employees are required to provide one hour of service. It should be noted that this measure does not include Purchased Transportation employees or vehicle revenue hours. The 1990 average was 764 vehicle revenue hours per employee, which represents a nine percent increase or improvement over the 1987 level of 703.

- Bus mode was second in labor efficiency to Demand Response service. Bus averaged 1,038 hours per employee, or 2.3 employees per vehicle revenue hour. The level in 1990 represents a four percent improvement over 1987 levels.

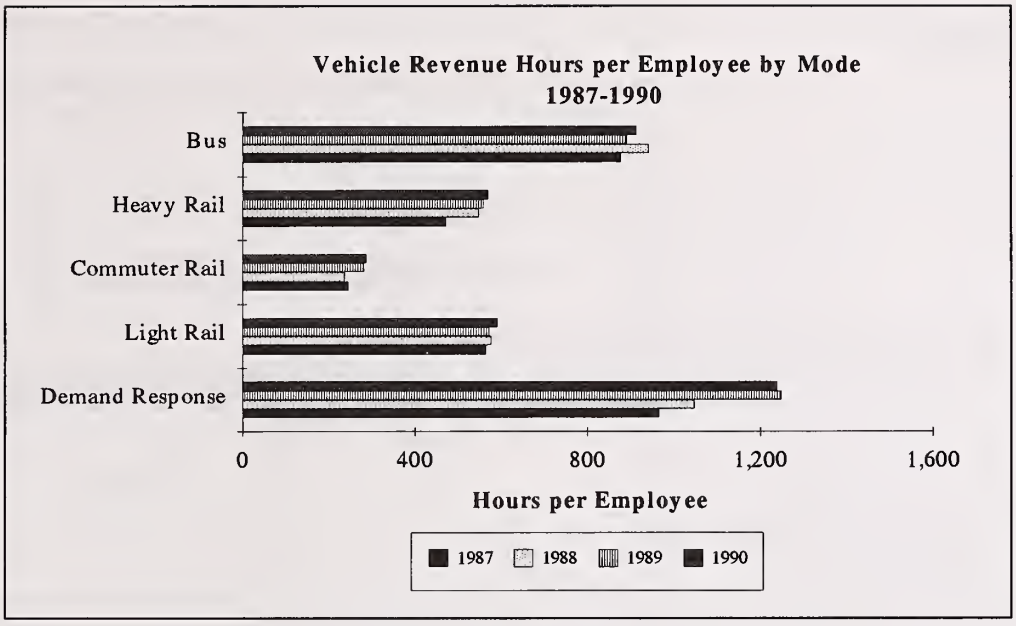
- Heavy Rail achieved 570 hours per employee, or 3.6 employees per hour. This represents a 21 percent improvement over 1987 levels. This measure suggests that Heavy Rail was able to contain costs effectively over four years.

- Commuter Rail was the least efficient mode by this measure, with 314 hours per employee, or 7.2 employees per hour of service. However, the 1990 level represents a 16 percent improvement over the 1987 level.

- Light Rail operated 593 hours per employee, requiring 3.5 employees for every hour of service. This represents a five percent improvement over 1987.

- Demand Response was the most labor efficient mode, at 1,240 hours per employee, or 1.7 employees per revenue hour. 1990 represents a 28 percent increase from the 1987 levels.

Exhibit 74



Cost Effectiveness: Operating Expense per Unlinked Passenger Trip by Mode

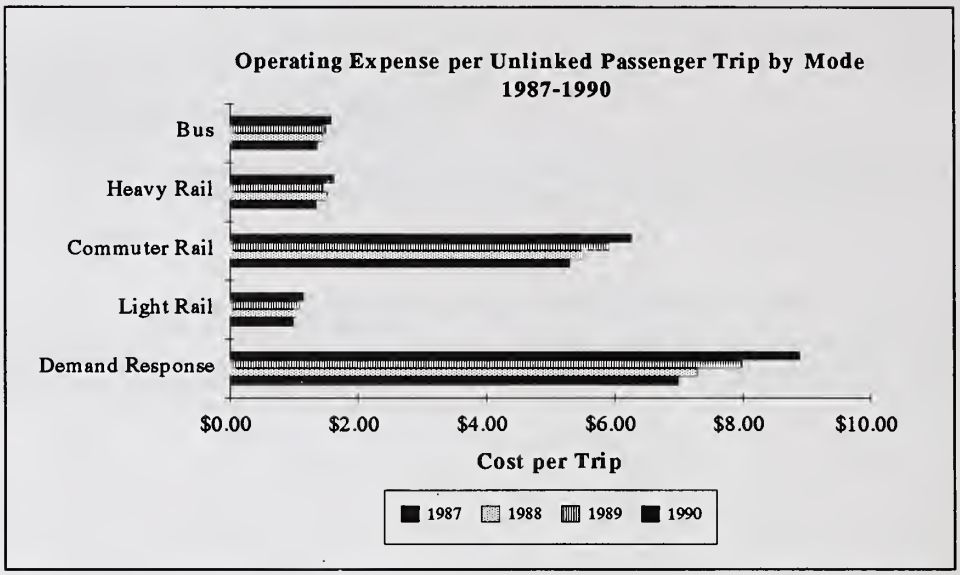
Exhibit 75 shows the cost per boarding passenger and evaluates the cost of the service in terms of service consumed. This contrasts with the service efficiency measures just discussed, such as operating expense per vehicle revenue mile or per vehicle revenue hour. Service efficiency measures compare service supplied to service inputs, such as dollars or employees. The cost effectiveness measures that follow compare service consumed to service inputs such as cost. They provide useful overall measures, but are difficult to interpret because input cost and consumption of output may not be related.

Total cost per trip, across all modes, averaged $1.83 in 1990. This is a 16 percent increase over 1987, or an increase averaging about six percent per year.

- Bus averaged $1.59 per trip, which represents an increase of 16.1 percent over the 1987 level, an average of approximately five percent per year. The increase almost duplicates the change in the CPI.

- Heavy Rail approached Bus in cost effectiveness; at $1.63 per trip, this represents an increase of 21.2 percent over the 1987 level, an average of less than 6.75 percent per year. As noted in Chapter 1, Heavy Rail service supplied increased significantly during the four year period. As noted in Chapter 2, passenger trips did not increase at the same pace. Costs are determined by the amount of service supplied. Therefore, when ridership levels do not keep pace with service levels, this indicator of cost effectiveness will decline.

Exhibit 75



- Commuter Rail does not compare well to the other modes by this measure, averaging $6.27 per unlinked passenger trip. As noted earlier, Commuter Rail passengers travel longer distances than other modes, which increases the cost per passenger trip. The 1990 value shows an increase of 18.1 percent over 1987 levels, representing an average of less than 5.8 percent per year.

- Light Rail becomes the most effective mode with this measure, at $1.15 per trip. This value represents an increase of 15 percent over the 1987 level, an increase averaging less than five percent per year.

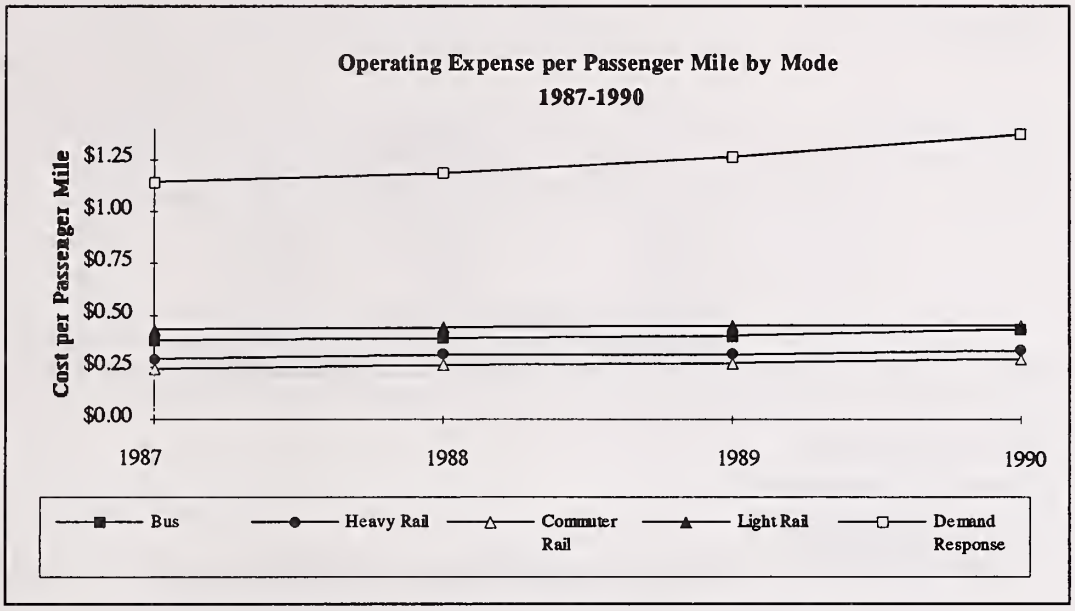
- In this measure Demand Response service becomes the least effective mode, averaging $8.89 per trip. The cost per trip in 1990 was 27 percent higher than the 1987 value, which indicates that increases averaged about 8.25 percent per year. As noted in Chapters 1 and 2, Demand Response experienced truly explosive growth in miles of service and in riders. Achieving an equilibrium between service demand and service cost is an ongoing challenge faced by this mode.

Cost Effectiveness: Operating Expense per Passenger Mile by Mode

Cost per passenger mile (Exhibit 76) takes into account the wide variance in average trip lengths among the modes, and measures the cost based on distance traveled. The average cost per passenger mile across all modes was $.38 in 1990. This represents a 16 percent increase over the 1987 average of $.33. This is approximately equivalent to the increase in the CPI.

- Bus mode averaged $.43 per passenger mile. Bus experienced a 15 percent increase in this measure after 1987, less than the increase in the CPI.

Exhibit 76



- Heavy Rail averaged $.33 per passenger mile. The increase for Heavy Rail parallels that of Bus, at 15 percent over four years. Note that this increase falls within the CPI, whereas cost per passenger trip exceeded the CPI. Trip lengths increased, which is likely related to new segments that were opened for revenue service.

- Commuter Rail becomes the most effective mode using this method of evaluation. Commuter Rail averaged $.29 per passenger mile, which represents an increase of 20 percent over 1987, or roughly 6.25 percent per year.

- Light Rail is very similar to Bus, at $.45 per passenger mile. Light Rail increased only 5.2 percent in this measure after 1987, averaging about 1.75 percent per year.

- Demand Response is again the most expensive mode, at $1.37 per passenger mile. Cost increases averaged 20 percent since 1987, averaging 6 percent per year. Note that the cost increase is smaller than the cost increase for passenger trips. This is attributable to longer average trip lengths.

Performance Measures by Size of Bus Fleet

Exhibit 77 provides an overview of the performance measures that follow. Cost efficiency and cost effectiveness do not form a linear progression from small systems to large. Instead, the smallest systems (fewer than 25 buses) were more expensive than the small systems (25 to 99 buses) across all cost measures, perhaps due to economies of scale. Likewise, while the largest systems (over 250 buses) were the most cost-effective in the measure of Operating Expense per Unlinked Passenger Trip, large systems (99 to 249 buses) were the most cost-effective in Operating Expense per Passenger Mile.

Exhibit 77

Selected Performance Measures by Size of Bus Fleet
1990

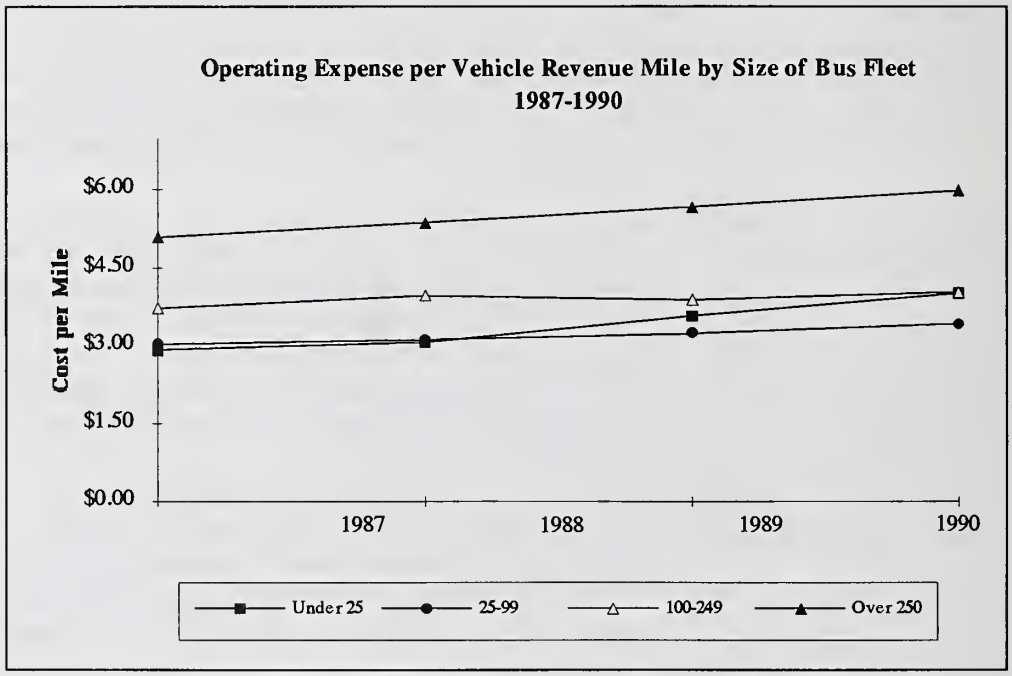
Number of Buses	Measures				
	Cost per Vehicle Revenue Mile	Cost per Vehicle Revenue Hour	Vehicle Revenue Hours Per Employee	Cost per Unlinked Passenger Trip	Cost per Passenger Mile
Under 25	$4.00	$56.69	1,111	$2.54	$.63
25-99	$3.40	$48.24	1,052	$1.76	$.40
100-249	$4.03	$54.90	956	$1.83	$.36
250 and Over	$5.97	$71.78	869	$1.50	$.44
Weighted Average	$5.12	$64.98	946	$1.59	$.43

Note: Slight deviations in totals may occur due to rounding.

Service Efficiency: Operating Expense per Vehicle Revenue Mile by Size of Bus Fleet

Cost per mile increases steadily with the size of bus system. (Exhibit 78)

Exhibit 78



- The smallest bus systems (less than 25 vehicles) were almost $2 per mile less expensive than the largest systems. Small systems averaged $4.00 per mile. These systems experienced a 37 percent increase since 1987, or roughly 11 percent per year.

- Systems with 25 to 99 buses averaged $3.41 per mile. This is an increase of 13 percent over 1987, or about four percent per year.

- Systems with 100 to 249 buses averaged $4.03 per mile. These systems con-

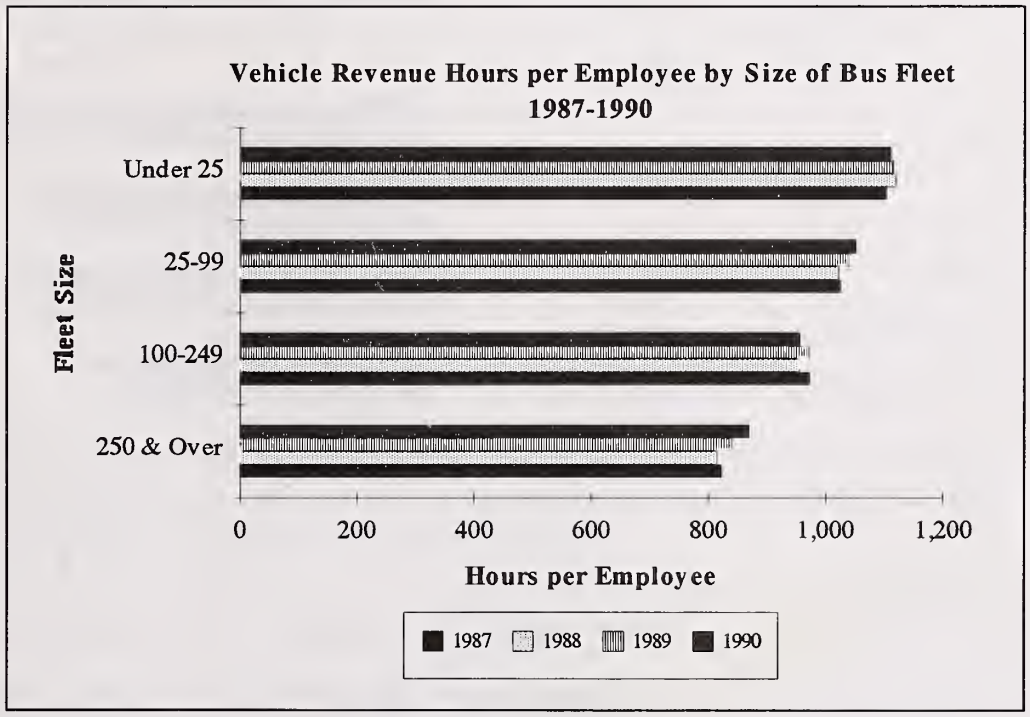
tained costs quite effectively. Increases were held to eight percent over four years, or an average of less than 2.75 percent per year.

- Systems with over 250 buses averaged $5.97 per mile. This figure is an increase of 17 percent over 1987. This averages less than 5.5 percent per year, and is slightly higher than the average increase in the CPI.

Labor Efficiency: Vehicle Revenue Hours per Employee by Size of Bus Fleet

Hours per employee decreases with the increase in system size. The trend since 1987 does not correlate with the changes in cost per mile noted above. (Exhibit 79)

Exhibit 79



- Small systems were the most efficient by this measure, at 1,111 vehicle hours per employee or roughly 1.9 employees per bus hour. This first ratio has improved over time, from a level of 1,104 in 1987.

- Systems with 25 to 99 buses improved steadily to a level of 1,052 vehicle hours per employee, or roughly two employees per bus hour. The 1987 level was 1025; 1990 showed an improvement of 2.6 percent.

- Systems with 100 to 249 buses achieved 956 vehicle revenue hours per employee, or roughly 2.2 employees for each hour of bus service. This represents a slight decline (less than two percent) from the 1987 level.

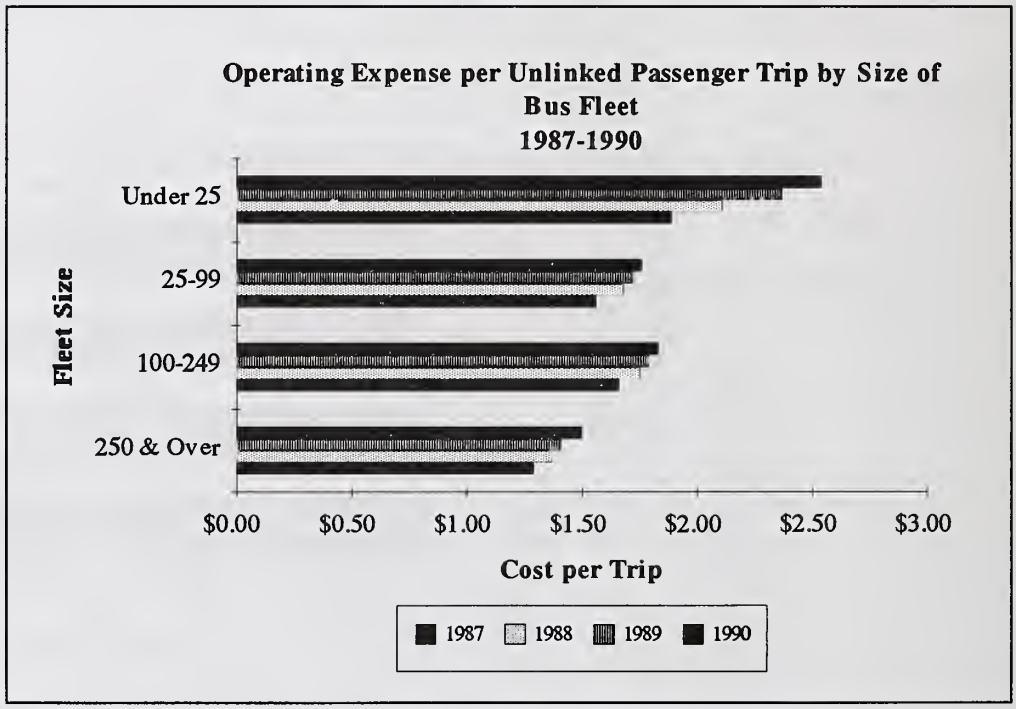
- The largest systems achieved 869 vehicle revenue hours per employee, or

roughly 2.4 employees per bus hour. This is an improvement of 5.5 percent over 1987 levels.

Cost Effectiveness: Operating Expense per Unlinked Passenger Trip by Size of Bus Fleet

In Exhibit 80, the cost effectiveness measures for buses by system size show a marked contrast to the cost efficiency measures noted above. The largest systems were the most cost effective in terms of passengers carried, due to higher population density and higher utilization of their services.

Exhibit 80



- Small systems, with fewer than 25 buses, averaged $2.54 per boarding passenger. This is an increase of 34 percent since 1987, or 10.25 percent per year.

- Systems with 25 to 99 buses averaged $1.76 per trip. This is an increase of 13 percent over four years, averaging about four percent per year.

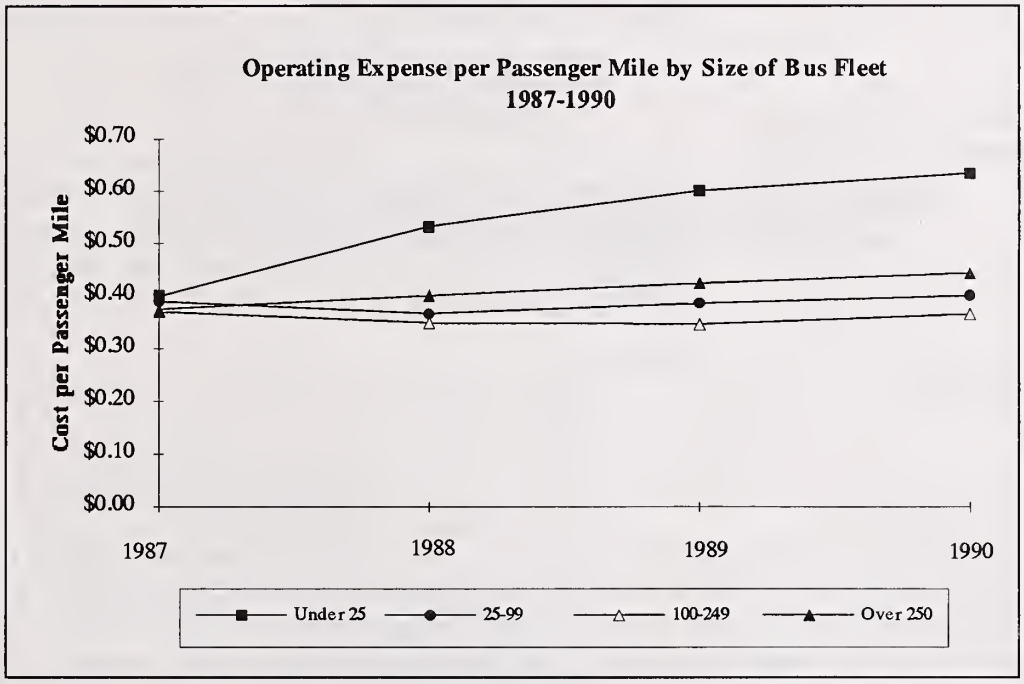
- Systems with 100 to 249 buses averaged $1.83 per year. The 1990 value is ten percent higher than 1987, representing an increase of about 3.2 percent per year.

- The cost per passenger for systems with more than 250 buses was $1.50. This represents an increase of 16 percent since 1987, or about five percent per year. This is almost exactly the increase in the CPI over the same period.

Cost Effectiveness: Operating Expense per Passenger Mile by Size of Bus Fleet

Cost per passenger mile again shifts the ranking of the systems. Here systems between 100 and 250 were the most cost effective. (Exhibit 81)

Exhibit 81



- The smallest systems averaged $.63 per passenger mile. This is an increase of 57 percent over 1987 levels. The trend is not regular, suggesting that there may have been data anomalies in earlier years.

- Systems with 25 to 99 buses averaged $.40 per passenger mile. This is an increase of only 1.1 percent over four years.

- Systems with 100 to 249 buses averaged $.36 per passenger mile. These systems exceeded the largest systems in this measure, in part because their average trip length is significantly greater than the largest systems, and because their unit costs of service are lower. The 1990 value is 1.4 percent lower than 1987. Passenger miles increased faster than passenger trips, suggesting longer average trip lengths.

- The cost per passenger mile for systems with more than 250 buses was $.44. This represents an increase of 18.4 percent over four years, or about 5.75 percent per year.

Performance Measures by Size of Urbanized Area

Measures by size of urbanized areas combine all modes for comparisons. The differences between modes and sizes of bus fleets are merged in the discussions that follows. The advantages and disadvantages for each respective measure are also shown in these comparisons.

Selected Performance Measures by UZA Size

Exhibit 82 previews the performance measures that follow. Large urbanized areas are the most expensive in the cost efficiency measures, but are the least expensive in cost per passenger mile. Mid-sized UZAs are the least expensive in cost per passenger trip. The graphs and tables that follow the overview provide the additional perspective of trends for the various measures.

Exhibit 82

Selected Performance Measures by UZA Size
1990

UZA Size	Measures				
	Cost per Vehicle Revenue Mile	Cost per Vehicle Revenue Hour	Vehicle Revenue Hours per Employee	Cost per Unlinked Passenger Trip	Cost per Passenger Mile
Under 200,000	$1.80	$.50	$2.68	$35.36	$.49
200,000 to 1 Million	$1.70	$.43	$3.48	$48.04	$.43
Over 1 Million	$1.86	$.38	$6.67	$98.57	$.38
Weighted Average	$1.85	$.39	$5.97	$87.12	$.38

Note: Slight deviations in totals may occur due to rounding.

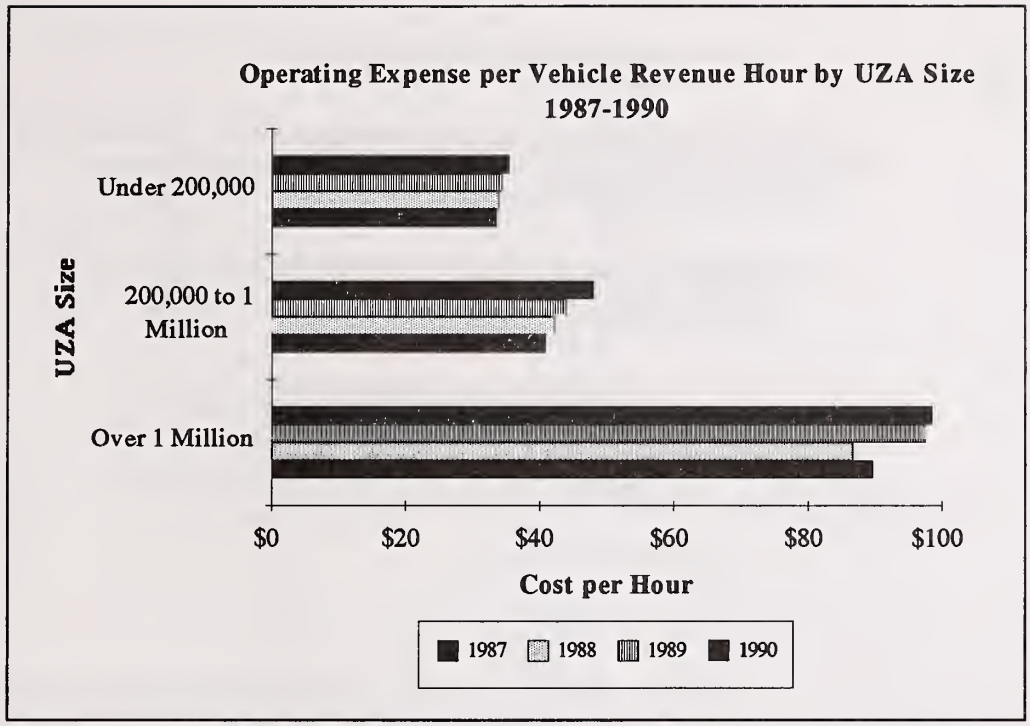
Service Efficiency: Trends in Operating Expense per Vehicle Revenue Hour by UZA Size

Operating expense per vehicle revenue hour increases with the size of urbanized area. (Exhibit 83)

- The smallest UZAs, from 50,000 to 200,000 population, averaged $35 per vehicle hour. Cost increases were contained at 5.3 percent over four years, averaging 1.75 percent per year.

- UZAs between 200,000 and one million population averaged $48 per hour. This represents an increase of 17.4 percent over four years, or 5.5 percent per year.

Exhibit 83



- UZAs exceeding one million in population experienced an average cost of $99 per vehicle hour, which is more than double the cost of service to the medium size UZAs, and almost triple the cost to the smallest UZAs. This is partly because the more expensive modes (Heavy Rail and Commuter Rail) operate in the larger UZAs. In addition, the largest UZAs experienced a higher cost of living and higher costs associated with labor agreements. Cost containment was effective in the largest UZAs, as the 1990 value was 9.9 percent higher than 1987. This averages less than 3.25 percent per year, less than the average increase in the CPI.

Service Efficiency: Operating Expense per Vehicle Revenue Mile by UZA Size

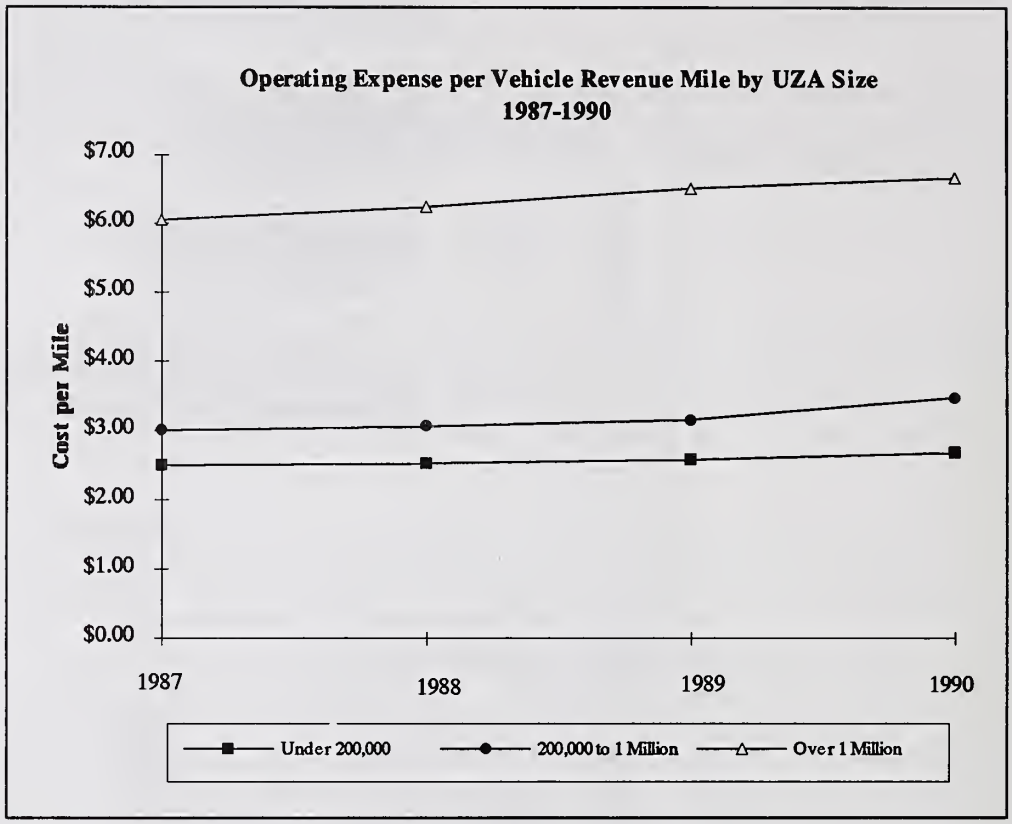
Cost per mile, like cost per hour, increases with the size of urbanized area. (Exhibit 84)

- The smallest UZAs, from 50,000 to 200,000 population, averaged $2.68 per vehicle mile. Cost increases were contained at 7.1 percent over four years, averaging about 2.3 percent per year.

- UZAs between 200,000 and one million population averaged $3.48 per mile. This represents an increase of 16.2 percent over four years, or about 5.1 percent per year.

- UZAs exceeding one million in population experienced an average cost of $6.67 per vehicle mile. The 1990 value is 10.3 percent higher than 1987. This averages about 3.3 percent per year.

Exhibit 84



Labor Efficiency: Vehicle Revenue Hours per Employee by UZA Size

Small UZAs have the highest level of labor efficiency (Exhibit 85) as measured in vehicle revenue hours per employee.

- Small UZAs averaged 1,312 vehicle hours per employee, or roughly 1.6 employees per vehicle hour. This level is a 2.1 percent improvement over 1987.

- Medium UZAs averaged 1,231 vehicle hours per employee, or roughly 1.7 employees per vehicle hour. This level is a 5.3 percent improvement over 1987.

- Large UZAs averaged 819 vehicle hours per employee, or roughly 2.5 employees per vehicle hour. This level is an 8.6 percent improvement over 1987. The low level of hours and the marked improvement correlate to the changes in rail modes and large bus systems noted above.

Exhibit 85

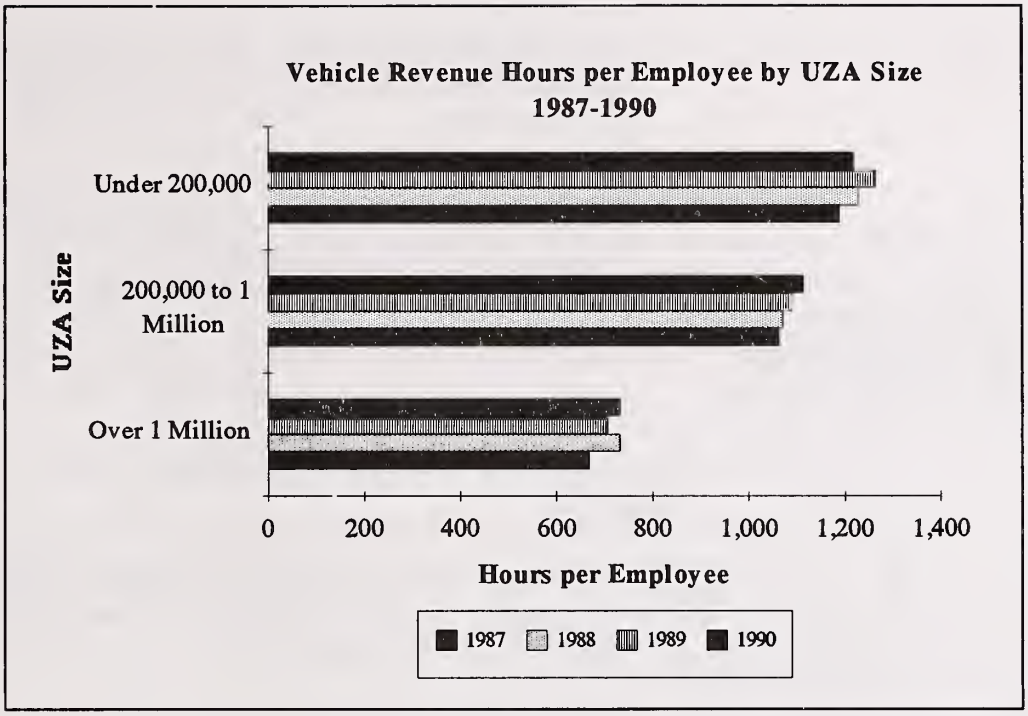
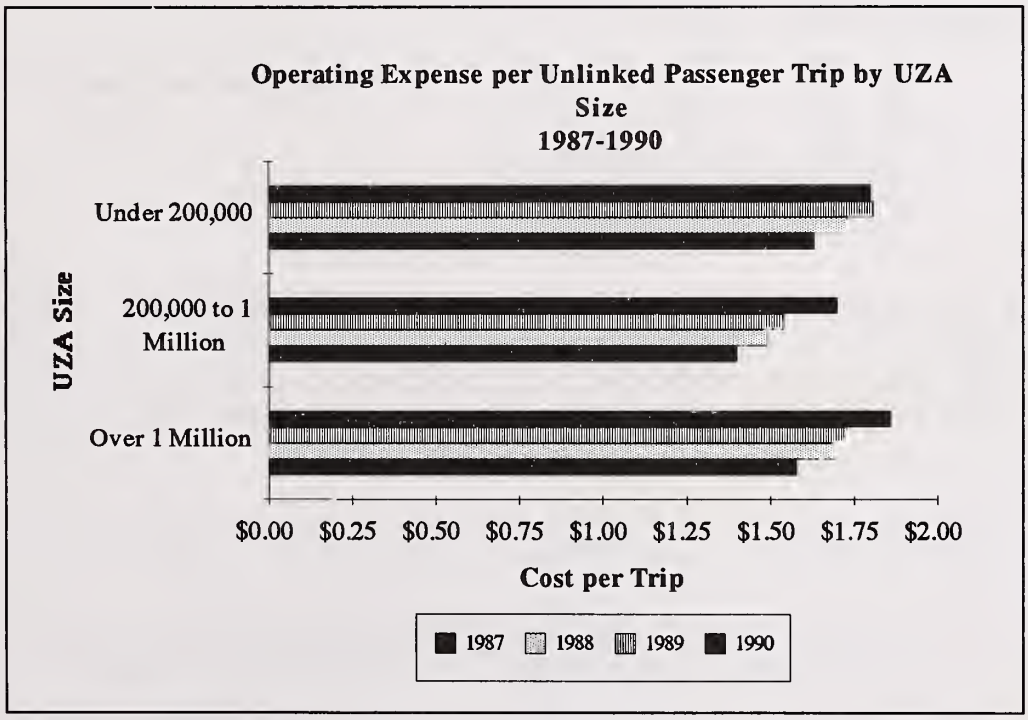


Exhibit 86



Cost Effectiveness: Operating Expense per Unlinked Passenger Trip by UZA Size

Mid-sized UZAs are the most effective in terms of cost per unlinked passenger trip. (Exhibit 86)

- The smallest UZAs, from 50,000 to 200,000 population, averaged $1.80 per boarding passenger. Cost increases were contained at 10.3 percent over four years, averaging about 3.3 percent per year.

- UZAs between 200,000 and one million population averaged $1.70 per trip. This represents an increase of 21.8 percent over four years, or about 6.75 percent per year.

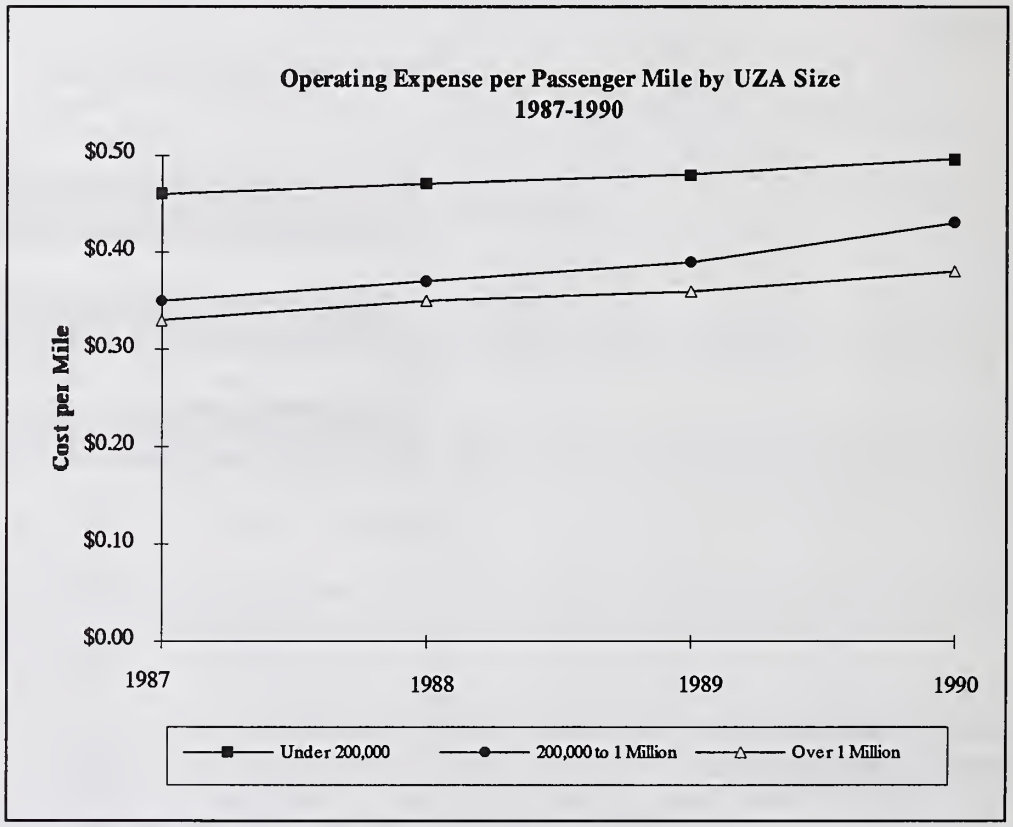
- UZAs exceeding one million in population experienced an average cost of $1.86 per trip. The 1990 value is 17.9 percent higher than 1987. This averages about 5.7 percent per year.

Cost Effectiveness: Operating Expense per Passenger Mile by UZA Size

The largest UZAs are the most effective in terms of cost per passenger mile. (Exhibit 87)

The smallest UZAs, from 50,000 to 200,000 population, averaged $.49 per boarding passenger. Cost increases were contained to 8.7 percent after 1987, averaging about 2.8 percent per year.

Exhibit 87



UZAs between 200,000 and one million population averaged $.43 per passenger mile. This represents an increase of 21.5 percent over four years, or about 6.7 percent per year.

UZAs exceeding one million in population experienced an average cost of $.38 per passenger mile. The 1990 value is 14.8 percent higher than 1987. This averages about 4.7 percent per year.

Performance Measures by Region

Performance by region again exhibits the differences between sizes of urbanized areas and their modal choices. Although every region has large urbanized areas with developed rail systems, the age, size and scale of such systems vary widely. Urban densities also vary from one region to another. Therefore performance measures vary widely.

Selected Performance Measures by Region

Exhibit 88

Exhibit 88 provides an overview of the performance measures that follow.

Selected Performance Measures by Region
1990

Region	Measures	
	Cost per Hour	Vehicle Hours per Employee
Mid-Atlantic	$ 71	735
North Central	$ 63	890
Northeast	$113	653
South/Southwest	$ 46	991
West	$ 67	906
Weighted Average	$ 87	792

Note: Slight deviations in totals may occur due to rounding.

Service Efficiency: Operating Expense Per Vehicle Revenue Hour by Region

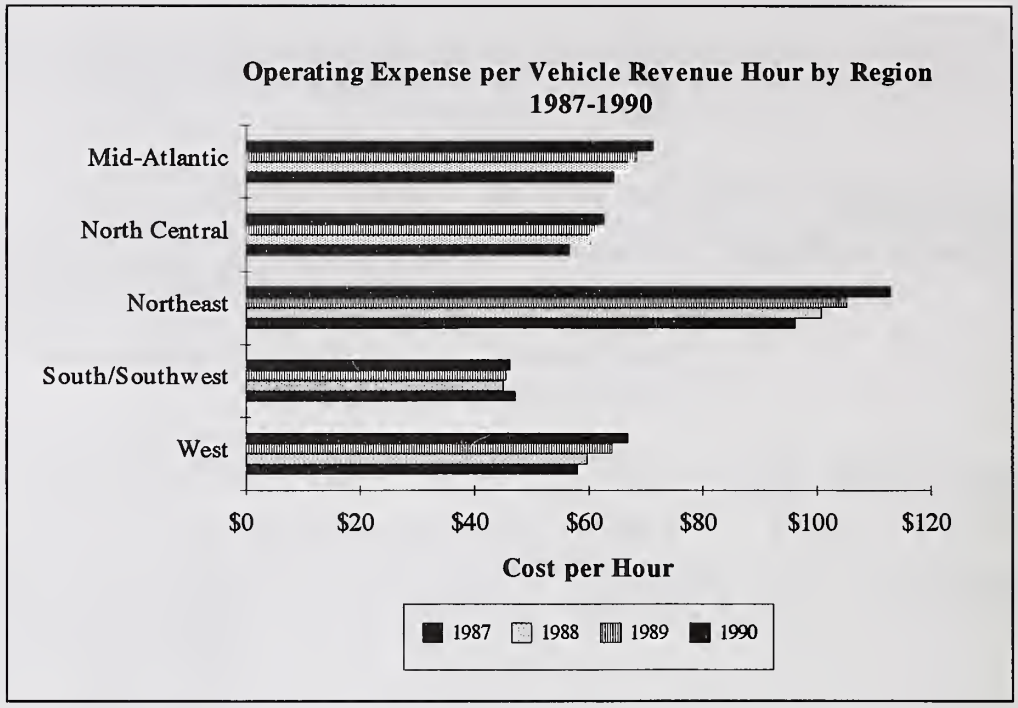
The Northeast was the most expensive region on a per hour basis, (Exhibit 89) at $113 per hour. Rail modes and large systems characterize this region, in addition to high costs of living and contractual provisions contained in labor agreements. Cost increases totaled 17.4 percent over the four years, an average of 5.5 percent per year.

- The Mid-Atlantic follows in cost at $71 per hour. Cost increases were limited to 10.6 percent over the four years, an average of about 3.4 percent per year.

- The West is similar to the Mid-Atlantic region in cost, at $67 an hour. Cost increases were contained at 15.1 percent, or about 4.8 percent per year.

- The North Central region had an average cost of $63 an hour. Similar to the Mid-Atlantic, cost increases were limited to 10.8 percent over the four years, an average of about 3.5 percent per year.

Exhibit 89



- The South-Southwest was the least expensive, at $46 an hour. Here, the cost per hour decreased by 1.9 percent from the 1987 level.

Labor Efficiency: Vehicle Revenue Hours per Employee by Region

The pattern in hours per employee is almost a mirror image of the pattern of expense noted above. (Exhibit 90)

Again, the Northeast had the lowest labor efficiency (in this case the lowest value), at 653 revenue hours per employee. However, the Northeast also experienced the biggest increase in labor efficiency. Hours per employee increased by 13 percent over the 1987.

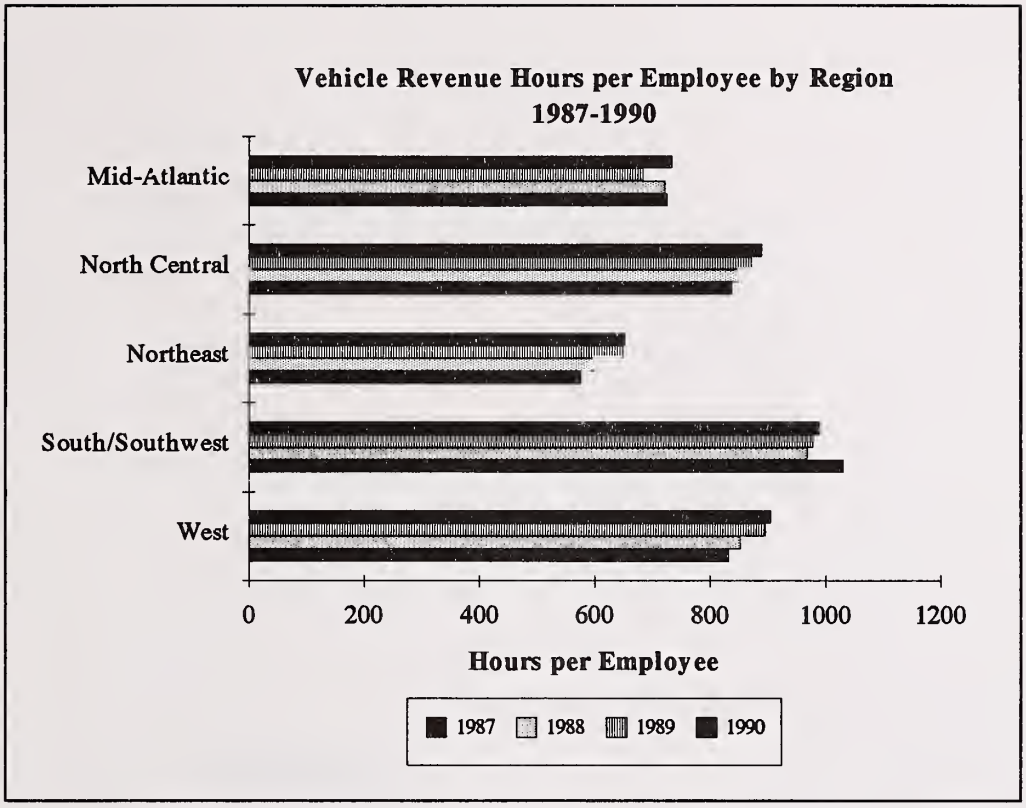
- The Mid-Atlantic followed at 735 vehicle hours per employee. Efficiency improved by one percent over the four years.

- The North Central region averaged 890 vehicle hours per employee. This is an increase of six percent over 1987.

- The West averaged 906 vehicle hours per employee. This is an increase of ten percent over 1987.

- Operators serving the South-Southwest were the most labor-efficient, at 991 hours per employee. Contrary to the trend in cost per hour, above, productivity declined slightly since 1987. The 1990 value was four percent less than the 1987 value.

Exhibit 90


Vehicle Revenue Hours per Employee by Region
1987-1990
Mid-Atlantic
North Central
Northeast
South/Southwest
West
0
200
400
600
800
1000
1200
Hours per Employee
1987
1988
1989
1990

Chapter 5

Operating and Capital Funding

Introduction

The previous chapter discussed the operating expenses and key expense elements involved in providing transit service. The discussion of how much service costs examined patterns in expenses that explain, on very basic levels, why operating expenses vary from one mode to another, or from one UZA size to another. Performance measures compared expenses to service levels and to service consumption. Dramatic differences appear by mode, by size of bus fleet, by size of urbanized area, and by region, depending on which measure you choose as the key for evaluation.

However, operating expense is only one side of the equation of transit finances. Paying for the service is often the most fundamental issue. Many, if not most, transit systems are engaged in a perpetual struggle to balance the competing demands for more service with the need to reduce or contain costs. Operating subsidies from local, State or Federal taxpayers are subject to public scrutiny and limitations. When passenger fares are tapped for substantial increases, agencies face declining ridership. This chapter discusses the patterns and trends in funding service. Changes in Federal, State, and local operating funds are discussed in the context of the size of urbanized area and region. Performance measures relate passenger fares to miles of service and to operating expenses.

Discussing the funding methods for the daily operations of service does not give a complete picture of funding requirements, although operating funding represents more than 75 percent of total transit funding. Funding for capital investments, such as buses, trains, rail lines, or other infrastructure, consumes almost one quarter of all transit funding. This chapter examines patterns and trends in capital funding, as well as operating funding. Evaluation measures focus on spare ratios and average fleet age. Miles of fixed guideway (such as tracks and high occupancy vehicle lanes) are also discussed.

The number of vehicles in maximum service was discussed earlier in the chapter on Service Supplied. Related performance measures, including miles per vehicle per year and peak to base ratio, were also discussed in that chapter.

The question of how the service is paid for can be answered through an examination of transit industry revenue sources. Both operating and capital assistance are reviewed.

Size of Urbanized Area

Urbanized area size is a key variable in the Federal apportionment of both capital and operating assistance. Urbanized areas with less than 200,000 population receive funds that have been apportioned by their respective State governors. Urbanized areas with over 200,000 population receive direct apportionment's. Separate tiers and related formulas for allocating funds have been established for urbanized areas greater than and less than one million population.

The mix of funding sources varies markedly among the different population groups. Urbanized area size also indirectly captures the effects of population size and density and the scale of transit operations on fare revenues.

Mode and Size of Bus Fleet

Revenue is not reported by mode under Section 15, and therefore cannot be analyzed for this report. Funding sources such as grants for total system deficits are not modally based. For the same reason, revenue by bus system size is not available.

Chapter Organization

The review of funding sources is divided into three sections:

Sources of Operating Revenue

The first section reviews current year operating revenue information in detail, with four-year trends for added perspective.

Operating Revenue Performance Measures

The second section introduces operating revenue-related performance measures such as passenger (fare) revenue divided by operating expense (revenue to cost ratio), and passenger revenue per vehicle revenue mile. These indicators are reported by region and by population.

Sources of Capital Funding

The third section presents a summary of national capital funding by major component, including the four-year trend. Recent downward trends in the age of the nation's transit fleet suggest some results of capital funding. The fleet is subdivided by major vehicle type, roughly equivalent to mode. Trends in spare ratios by mode are also presented. Further insight into the transit infrastructure comes from a table of trends in fixed guideway miles by mode.

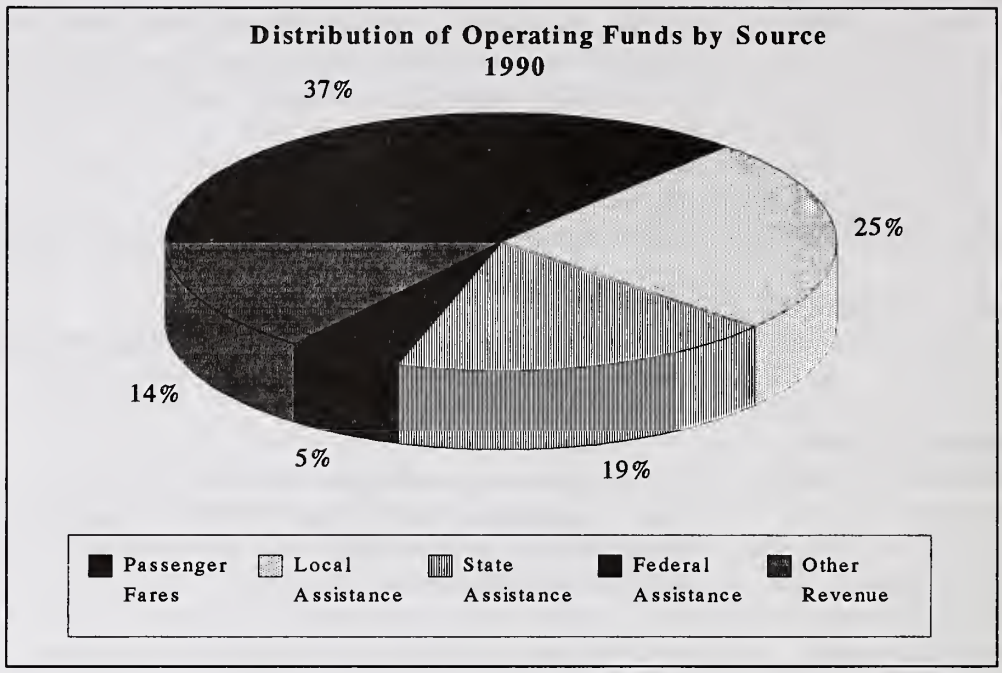
Operating Revenues

Operating revenues include all categories of passenger fares, Federal, State, local assistance and other revenues. Passenger fares include farebox receipts, monthly or weekly passes, and special arrangements such as set fees to allow post office employees or students to ride free or at reduced fares. Federal revenues include general grants for operating assistance, special planning grants and other Federal aid. State and local assistance includes outright grants and special assistance to encourage the transit agency to offer reduced fares to the elderly or the disabled. Other revenue includes funds dedicated to transit at their source, which are subsidies, and miscellaneous revenues such as advertising income, which are earned.

Distribution of Operating Funds by Source

Exhibit 91, Distribution of Operating Funds by Source, reveals that passenger fares were the largest single source of transit operating funds; 37 percent of all operational funding in 1990 was generated by passenger fares. Local assistance and other revenue (which consists of funds dedicated to transit at their source and non-transportation revenues) combined to fund 39 percent of operating expense. State funds contributed almost 19 percent, while the Federal government contributed five percent.

Exhibit 91



Sources of Operating Funds

Total operating funding increased by $1.8 billion or 13.5 percent from 1987 to 1990, as shown in Exhibit 92, Sources of Operating Funds.

- Passenger fares almost kept up with the rate of growth in funding. Fares increased by $660.5 million or 13 percent from 1987 to 1990. This averages about 4.3 percent per year. The proportion of funding paid through passenger fares remained a very stable 36 to 37 percent between 1987 and 1990.

- State funds increased by $394 million or 16 percent over the same period. This averages more than five percent per year. The share of State assistance remained almost constant, ranging from 18 percent in 1987 to 19 percent in 1990.

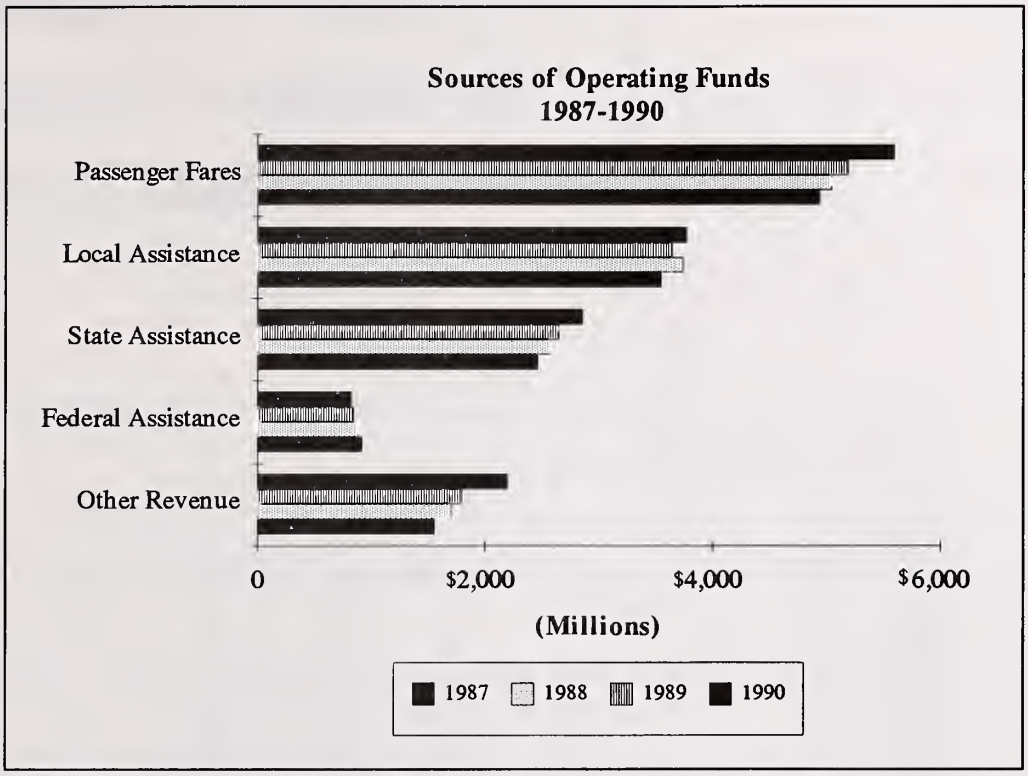
- Federal assistance declined by $94 million or ten percent. The decline averages about three percent per year. The share of Federal assistance also declined over time. Federal assistance supported seven percent of operations in 1987 and declined to five percent in 1990.

- Local assistance increased by $217 million or six percent over the four years; the average was about two percent per year. Since this is less than the increase in total funding, the share of local non-dedicated assistance declined. In 1987 local assistance supported 26 percent of operations; in 1990 it supported 25 percent.

- Other revenues, including dedicated assistance, filled the gaps left by Federal and local funding. These funds increased by $642.4 million or 41 percent over the four years. The increase averages more than 12 percent per year. The

share of funding increased steadily from 12 percent in 1987 to 14 percent in 1990. This may indicate a trend toward more local sources of funding dedicated directly to transit rather than a reliance on general funds.

Exhibit 92



Distribution of Operating Funds by UZA Size and Source

Exhibit 93, Distribution of Operating Funds by UZA Size and Source, shows that the characteristics of funding vary dramatically according to the size of the urbanized area population.

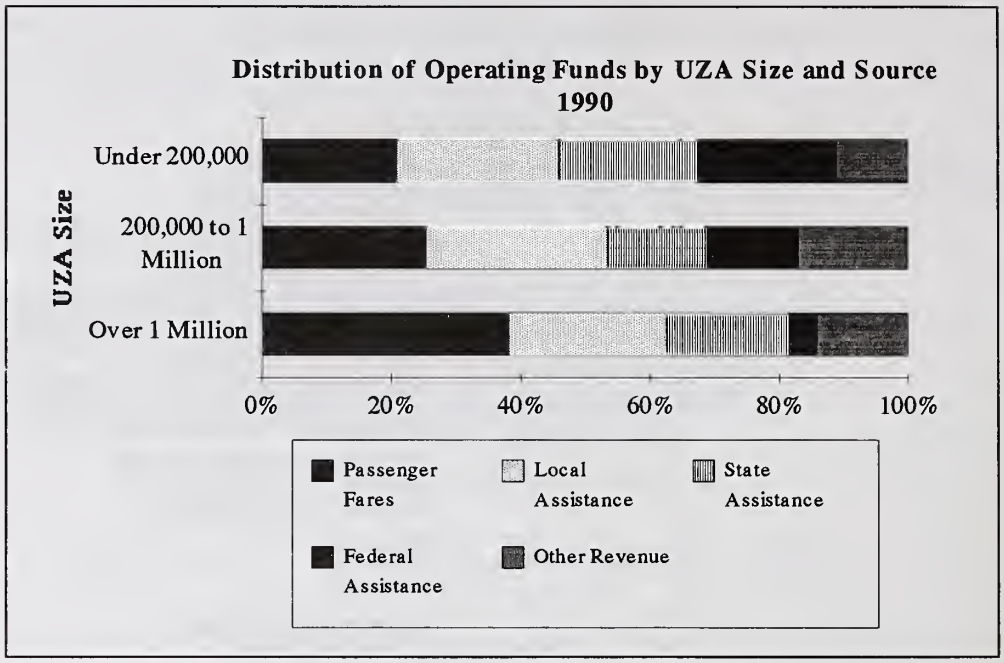
Reliance on passenger fares increased with the size of the urbanized area.

- The smallest urbanized areas (50,000 to 200,000 population) gained 21 percent of their funding from passengers.
- Areas with populations between 200,000 and one million received 25 percent of their funding from passengers.
- Areas with over one million population received 38 percent of their operating funding from passengers.

Conversely, reliance on Federal assistance declined with the size of urbanized area.

- Federal funding contributed 21 percent of the cost of operations for the smallest areas.

Exhibit 93



- Federal funds subsidized 14 percent of the cost of operations for mid-sized UZAs.

- Federal funds subsidized four percent of the cost of operations for urbanized areas with over one million population.

The balance of funding came from combinations of State assistance, local assistance, and other revenues. The proportion of funding paid by these combined sources is very consistent across different sizes of urbanized areas.

- These combined sources provided 58 percent of funding for UZAs under 200,000 population.

- State, local, and other revenues provided 61 percent of the funding for areas between 200,000 and one million population.

- These sources provided 58 percent of operating funding for UZAs over one million population.

Sources of Operating Funds by UZA Size

As noted above, the trend in transit funding has been toward a decreased role of Federal funding offset by increased sources of local funding. However, Exhibit 94, Operating Funds by UZA Size and Source, reveals that these changes have not been consistent among different sizes of urbanized areas.

For the smaller UZAs, between 50,000 and 200,000 population, Federal assistance increased six percent from 1987 to 1990. Total operating expenditures increased

nine percent. As a result, the proportion of Federal funding dropped slightly, from 22 percent to 21 percent.

- Fare revenues increased three percent. The proportion of funding paid through fares declined from 22 percent to 21 percent.

- State, local, and other revenues increased 14 percent, or less than five percent per year.

- The number of systems reporting increased by five, or 2.5 percent.

Exhibit 94

Sources of Operating Funds by UZA Size
(millions)
1987-1990

UZA Size	Year	Operating Funds by UZA Size					Total
		Passenger Fares	Local Assistance	State Assistance	Federal Assistance	Other Revenue	
Under 200,000	1987	$84.9	$113.8	$73.4	$84.9	$24.8	$381.9
	1988	87.2	114.1	81.9	93.1	33.7	410.0
	1989	89.6	116.9	85.3	97.5	44.4	433.8
	1990	86.9	104.6	89.8	89.9	47.0	418.2
200,000 to 1 Million	1987	263.3	227.3	129.8	174.1	189.0	983.5
	1988	268.4	261.8	136.8	159.4	205.3	1,031.8
	1989	280.8	282.1	144.5	160.8	226.7	1,095.0
	1990	289.1	319.7	175.8	158.4	195.8	1,138.7
Over 1 Million	1987	4,590.2	3,206.4	2,260.5	656.5	1,343.2	12,056.8
	1988	4,689.8	3,361.2	2,354.9	605.8	1,462.9	12,475.4
	1989	4,814.0	3,242.1	2,418.6	588.1	1,525.7	12,588.5
	1990	5,216.7	3,339.9	2,593.4	573.7	1,956.1	13,679.8
Total Dollars	1987	4,938.4	3,457.5	2,463.7	915.6	1,557.1	13,422.0
	1988	5,045.4	3,737.1	2,573.6	858.3	1,701.9	13,916.3
	1989	5,184.4	3,641.2	2,648.5	846.3	1,796.8	14,117.1
	1990	$5,592.7	$3,764.2	$2,858.9	$822.0	$2,198.9	$15,231.4

Note: Slight deviations in totals may occur due to rounding.

UZAs between 200,000 and one million population experienced a ten percent decrease in Federal funds, compared to a 16 percent increase in total funds. Total funding increased about five percent per year. The share of Federal funding decreased from 18 percent to 14 percent of funding.

- Passenger fares increased ten percent, or about 3.5 percent per year, not enough to offset total funding increases. The share of passenger revenues declined from 27 percent to 25 percent of funding.

- State, local, and other revenues increased 26.5 percent, or more than eight percent per year.

- The number of systems increased by two, or two percent.

UZAs over one million population experienced a 13.5 percent increase in total funding from 1987 to 1990, averaging less than five percent per year.

These large UZAs simultaneously experienced a 13 percent decrease in Federal funding. The Federal funding share declined from 5.4 to 4.2 percent of total funding.

- Passenger fares kept pace with general fund changes, increasing 14 percent over the period, or about four percent per year. Passenger fares retained a 38 percent level of total funding.

- State, local, and other revenues increased 16 percent, averaging about five percent per year, with a shift from local to other revenues.

- The number of systems reporting increased by 25, or 14.7 percent.

The Federal share of operating funding also may be illustrated from a different perspective. Total Federal operating assistance declined by nine percent from 1987 to 1990. During the same period, inflation increased general operating costs by 15.9 percent, not including service increases. Federal policies during this period encouraged flexibility in using general assistance for either operating or capital purposes; the decreases in operating assistance may also reflect local options to use Federal assistance for capital programs more than operations.

- UZAs over one million population received 72 percent of all Federal operating assistance in 1987; by 1990, that share was 70 percent of the decreased funding.

- UZAs between 200,000 and one million population saw their share of total FTA operating funding stay constant at 19 percent.

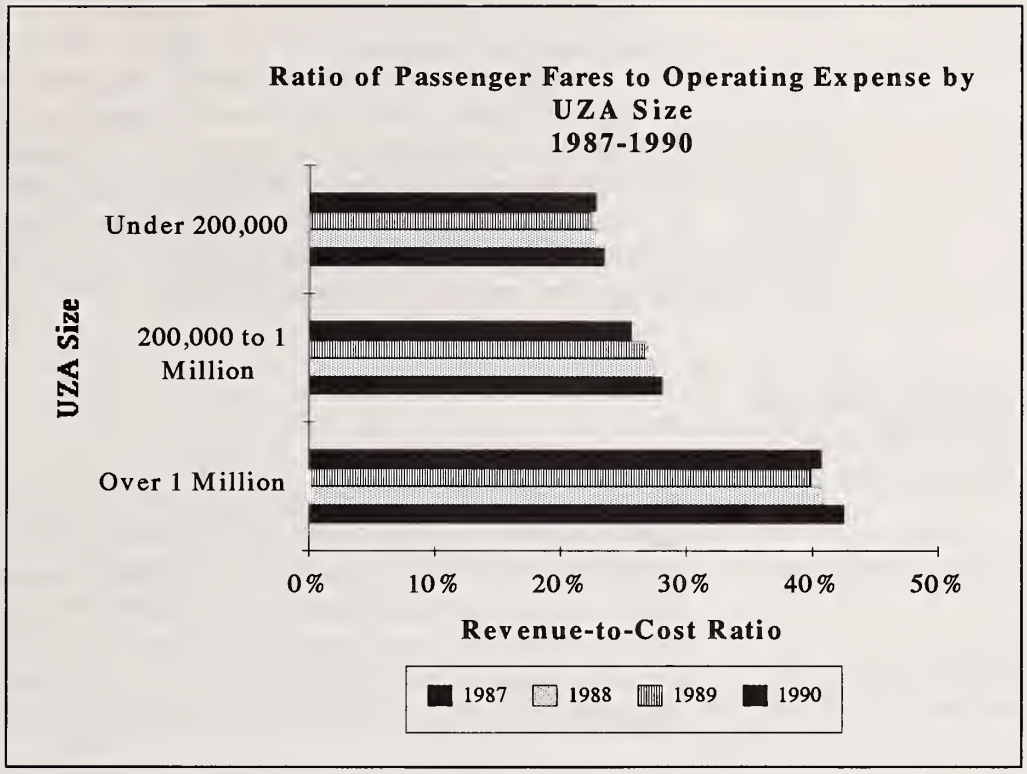
- The share for UZAs between 50,000 and 200,000 increased from nine percent to 11 percent.

Operating Revenue Performance Measures by Size of Urbanized Area

Ratio of Passenger Fares to Operating Expense by UZA Size

The revenue-to-cost ratio, also known as a cost recovery ratio, is a standard transit industry measure that compares passenger fares earned to the total operating cost of service. The earlier review focused on passenger fares and other sources of funding. In some cases, operating funding does not equal operating expense. (Some agencies report deficits or surpluses in funding.) As a result, there are slight differences in the ratios reported here in Exhibits 95 and 96, Ratio of Passenger Fares to Operating Expense by UZA Size, and the percentages of operating funds reported above.

Exhibit 95



Exhibits 95 and 96, Ratio of Passenger Fares to Operating Expense by UZA Size, reveal a wide variance based on the size of the urbanized area.

- Transit in smaller UZAs typically has a difficult time competing with the automobile. Free or inexpensive parking and lack of congestion means that smaller UZAs must compete with the automobile through attractive pricing strategies. The smallest UZAs recovered about 23 percent of their total operating expense from passenger fares, a ratio that has stayed constant for the four year period.

- UZAs between 200,000 and one million population experienced a gradual decline in the cost recovery ratio. In 1987, fares recovered 28 percent of operating expenses; in 1990, the ratio averaged 26 percent. The ratio declined more than two points, or 8.5 percent, which equates to a decline of about 2.7 percent per year.

Exhibit 96

Ratio of Passenger Fares to Operating Expense by UZA Size 1987-1990

UZA Size	Years			
	1987	1988	1989	1990
Under 200,000	23.5%	23.0%	22.4%	22.8%
200,000 to 1 Million	28.1%	27.4%	26.9%	25.7%
Over 1 Million	42.5%	40.8%	39.9%	40.7%
Weighted Average	40.8%	39.3%	38.4%	39.1%

Note: Slight deviations in totals may occur due to rounding.

- The largest UZAs tend to have expensive or limited general downtown parking, and may have methods such as rail or HOV bus lanes to provide competitive travel times in heavily congested corridors, which command premium fares. The higher levels of passenger utilization for large systems and large urbanized areas were noted in Chapter 2, Service Consumption. High utilization also helps in achieving higher cost recovery ratios. The cost recovery ratio for the largest UZAs slipped from 43 percent in 1987 to 41 percent in 1988. Cost recovery averaged 41 percent in 1990. The decline in the cost recovery ratio totals 1.8 points, or 4.2 percent, averaging about 1.3 percent per year.

Passenger Fares per Vehicle Revenue Mile by UZA Size

Passenger Fares per Vehicle Revenue Mile, Exhibits 97 and 98, compare fares earned with service provided. This comparison adds the element of passenger payment to the earlier comparisons of unlinked passenger trips per vehicle revenue mile. It also measures intensity of use and the fare policies of transit systems. Within individual transit systems, the trends can suggest the delicate fiscal balancing act between fare increases and service reductions (which tend to drive away customers) and selected service increases intended to attract new customers.

The fare revenue earned per vehicle revenue mile of service supplied increases with the size of urbanized area.

Exhibit 97

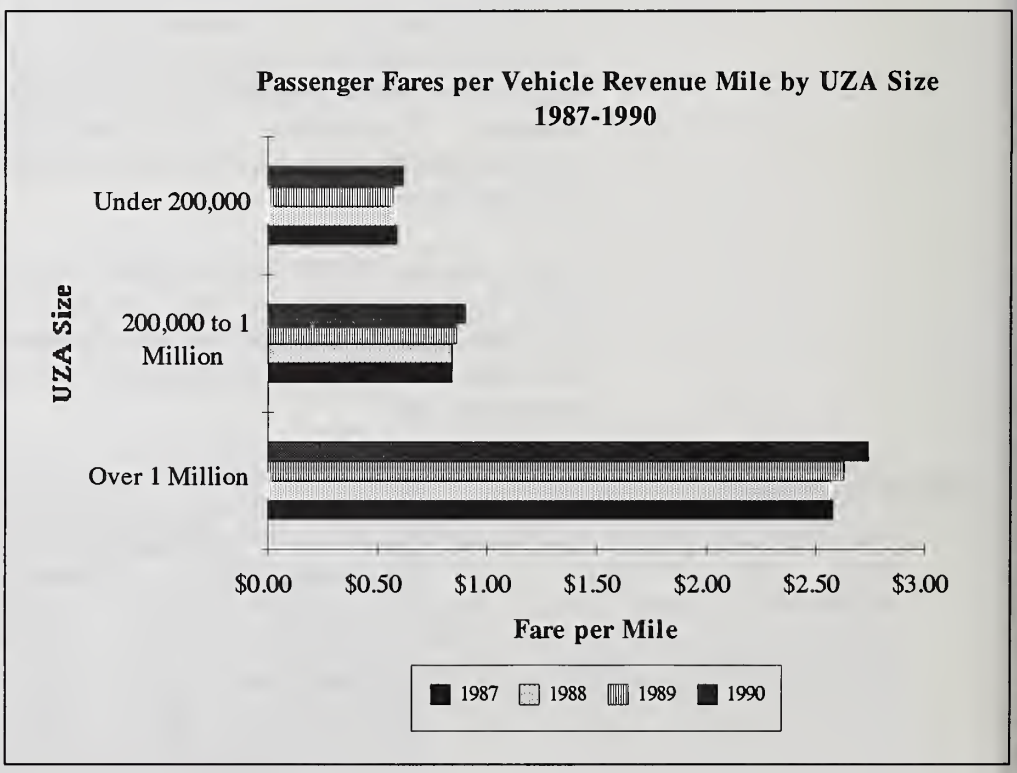


Exhibit 98

Passenger Fares per Vehicle Revenue Mile by UZA Size
1987-1990

UZA Size	Years			
	1987	1988	1989	1990
Under 200,000	$.59	$.58	$.58	$.62
200,000 to 1 Million	$.84	$.84	$.86	$.90
Over 1 Million	$2.58	$2.57	$2.63	$2.74
Weighted Average	$2.21	$2.20	$2.24	$2.36

Note: Slight deviations in totals may occur due to rounding..

- Small UZAs recovered $.62 in fare revenue for every mile operated in 1990. This represents an increase of $.03 or five percent from the $.59 attained in 1987. The increase averages about 1.7 percent per year.

- Mid-sized UZAs achieved $.90 in passenger fares per mile of service. The 1987 level was $.84. The 1990 level represents a seven percent increase, averaging about 2.3 percent per year.

- Large UZAs averaged $2.74 in fare revenue per mile. This is a six percent increase over the 1987 level of $2.58. Increases averaged two percent per year.

Operating Revenue Performance Measures by Region

Ratio of Passenger Fares to Operating Expense by Region

The Ratio of Passenger Fares to Operating Expense by Region, Exhibits 99 and 100, reveal that the Mid-Atlantic region achieved the highest cost recovery of any region, at 45 percent. This ratio remained unchanged for the four year period.

- The Northeast, the traditional leader in cost recovery, was very close to the Mid-Atlantic level at 44 percent. This value represents a decline from the 48 percent cost recovery of 1987. Cost recovery declined to 45 percent in 1988, declined again to 43 percent in 1989, and partially recovered to 44 percent in 1990. The four point change in cost recovery represents a decline of eight percent in the ratio, or an average of 2.7 percent per year.

- The North-Central region achieved a 33 percent cost recovery. This value remained stable after 1988, although in 1987 the ratio was almost 35 percent.

- The West averaged 32 percent cost recovery. This value represents an increase from the 30 percent cost recovery of 1987 and 1988. This 6.7 percent increase in the ratio averages about 2.2 percent per year.

- The South-Southwest averaged 28 percent cost recovery; the level varied between 29 and 30 percent over the four year period.

Exhibit 99

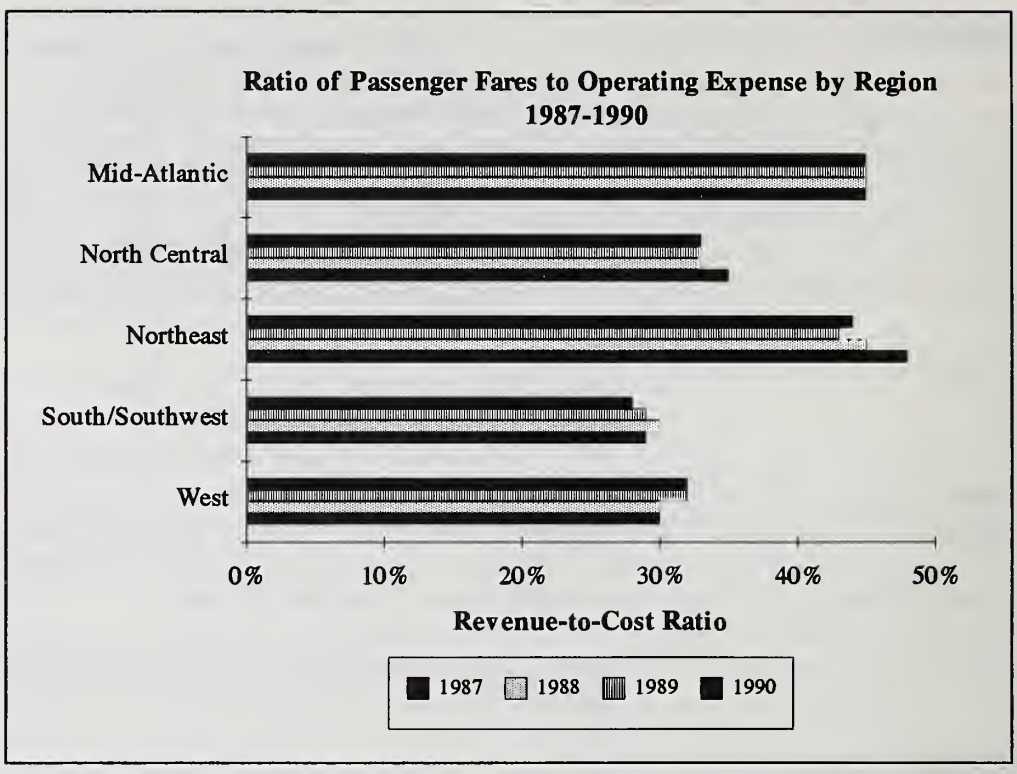


Exhibit 100

Ratio of Passenger Fares to Operating Expense by Region 1987-1990

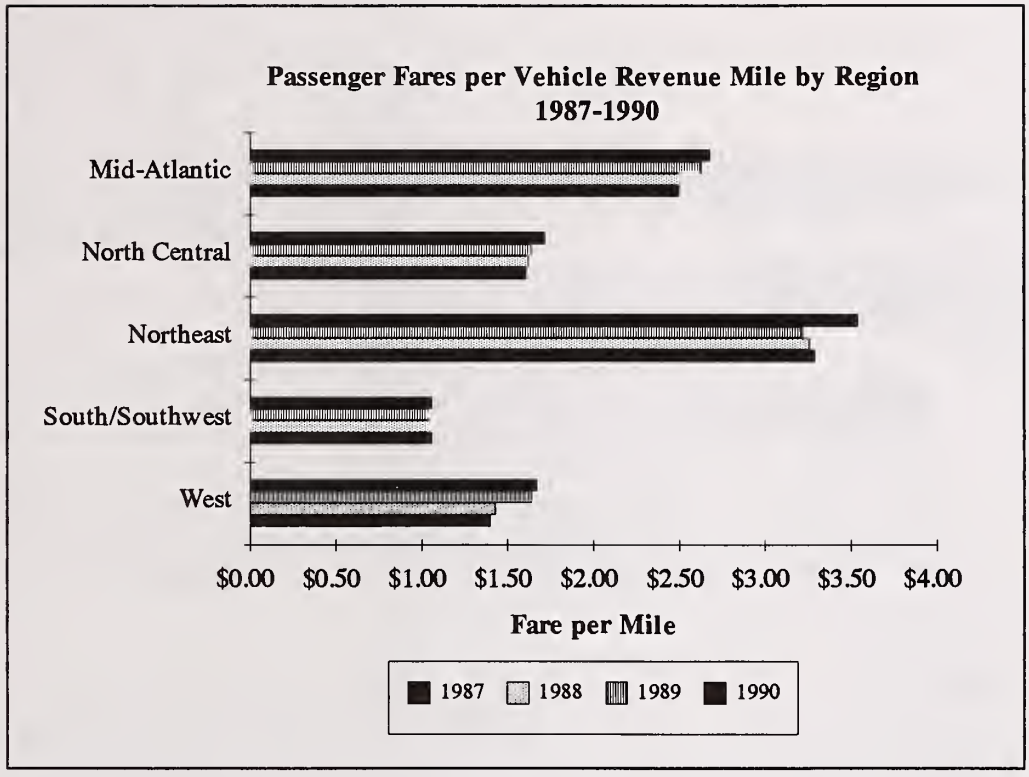
Region	Years			
	1987	1988	1989	1990
Mid-Atlantic	45.3%	44.7%	44.5%	44.9%
North Central	34.9%	33.4%	33.2%	33.4%
Northeast	48.0%	45.2%	42.7%	44.2%
South/Southwest	29.0%	30.0%	29.1%	28.4%
West	30.3%	29.6%	32.1%	31.6%
Weighted Average	40.8%	39.3%	38.4%	39.1%

Note: Slight deviations in totals may occur due to rounding.

Passenger Fares per Vehicle Revenue Mile by Region

Passenger Fares per Vehicle Revenue Mile, Exhibit 101 and 102, reveal a regional pattern that differs from the cost recovery ratio. As discussed in Chapter 3, Service Supplied, the regions expanded service in different patterns, and with different rates of increases in cost. In effect, this measure combines fare policies with policies on service levels. It also reflects the high intensity modes of service prevalent in various regions of the country.

Exhibit 101



- The Northeast was the highest, by a wide margin, earning $3.54 in passenger fares per mile of vehicle revenue service. This value represents an increase of almost eight percent over the 1987 level of $3.29. Fare revenue per mile increased an average of more than 2.5 percent per year.

- The Mid-Atlantic achieved $2.68 in fares per mile. The 1987 level was $2.50; this is an increase of seven percent, or almost 2.3 percent per year.

- The North-Central region averaged $1.72 in fare revenue per mile. This also represents a seven percent increase over 1987, or about 2.3 percent per year.

- The West dramatically increased its fare revenue per mile. The 1990 average was $1.67. This is a 19 percent increase over the 1987 level of $1.40, averaging six percent per year.

- The South-Southwest kept its fare revenue per mile unchanged at $1.06 since 1987. It dropped to $1.05 and $1.04 in 1988 and 1989, so in some respects 1990 represents a slight recovery.

Exhibit 102

Passenger Fares per Vehicle Revenue Mile by Region 1987-1990

Region	Years			
	1987	1988	1989	1990
Mid-Atlantic	$2.50	$2.51	$2.63	$2.68
North Central	$1.61	$1.62	$1.64	$1.72
Northeast	$3.29	$3.26	$3.22	$3.54
South/Southwest	$1.06	$1.05	$1.04	$1.06
West	$1.40	$1.43	$1.64	$1.67
Weighted Average	$2.21	$2.20	$2.24	$2.36

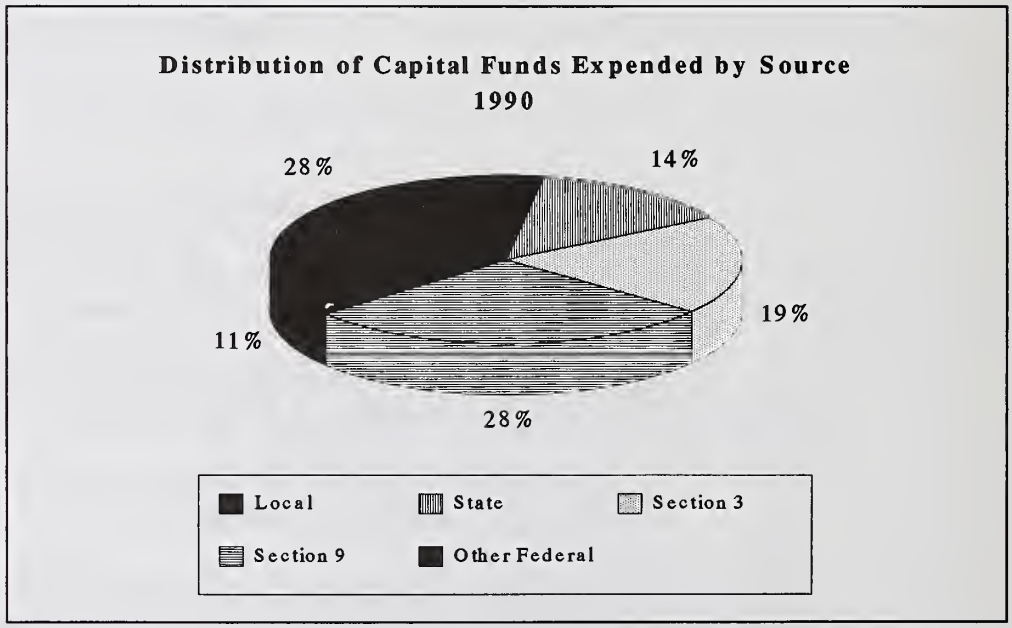
Note: Slight deviations in totals may occur due to rounding.

Capital Funds

Distribution of Capital Funds Expended by Source

Federal capital assistance increased and became the largest single source of transit capital funds, as shown in Exhibit 103. This is in contrast to a declining level of Federal operating assistance. Federal assistance represents 58.3 percent of $4.53 billion generated for transit infrastructure expansion and rehabilitation in 1990. As mentioned above in the discussion of operating assistance, the increases in Federal assistance for capital also reflect local options to increase the portion of Federal grants used for capital instead of operations.

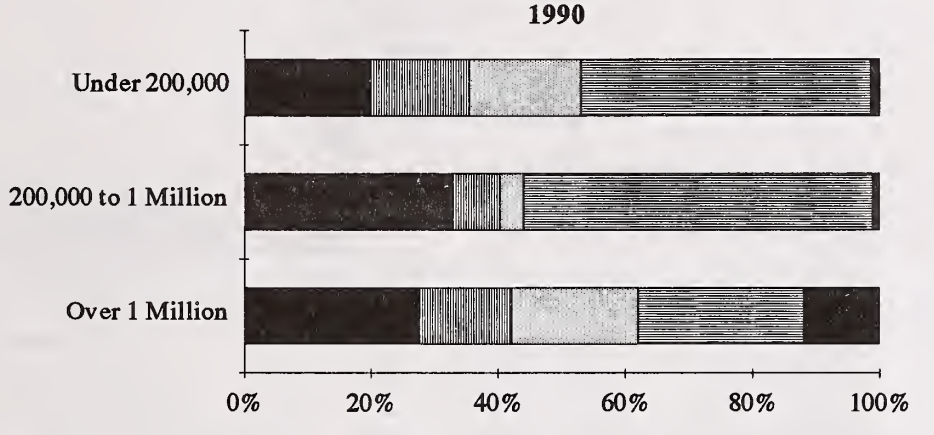
Exhibit 103



Distribution of Capital Funds Expended by UZA Size and Source

Large UZAs (above one million population) were responsible for $4.16 billion or 92 percent of capital funds from all sources in 1990, as shown in Exhibit 104. Ninety-one percent or $2.41 billion of Federal capital assistance was expended in these large UZAs. Section 3 funding, the Discretionary tier, is a key source of assistance for large UZAs, representing 20 percent of total capital funding. Large UZAs obtained 26 percent of capital funding from the Section 9 formula allocation, while 12 percent of funding was from other FTA, DOT, and other Federal funding sources. Forty two percent was from State and local sources.

Exhibit 104



Smaller urbanized areas show a very different pattern of funding. UZAs between 200,000 and one million obtained four percent of 1990 funding from Section 3. Section 9 provided a full 55 percent of funding. Only one percent of funding is from other Federal sources. State and local support amounted to 40 percent of total funding. Six percent or $166.7 million of Federal capital assistance was expended in these mid-size UZAs.

UZAs with less than 200,000 population obtained 18 percent of funding from Section 3. Section 9 provided 46 percent of funding. One percent of funding was from other Federal sources. State and local assistance supported 35 percent of capital funding. Two percent or $63.3 million of Federal capital assistance was expended in these small UZAs.

Trends in Overall Funding

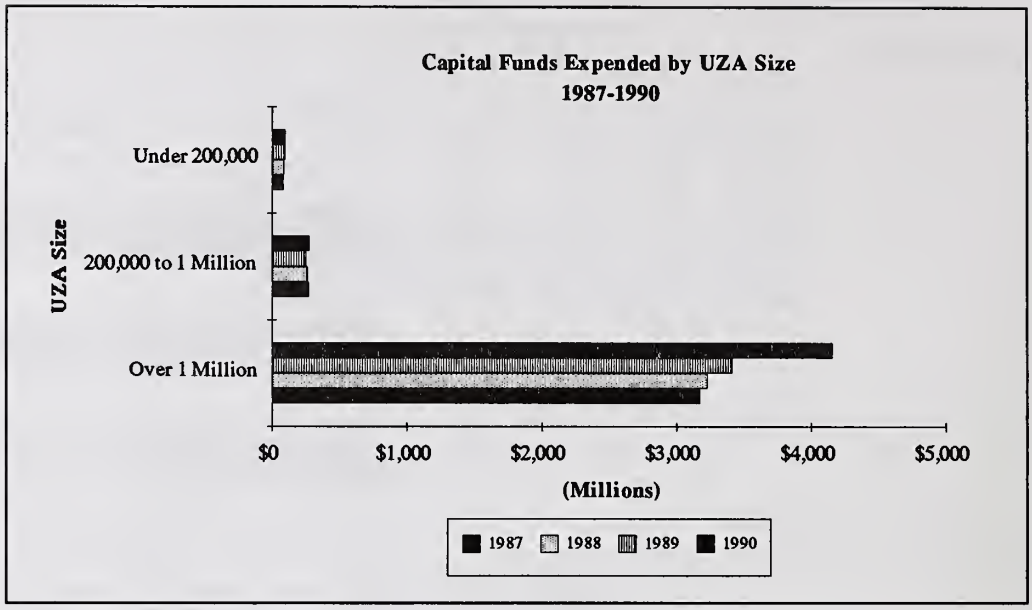
Total funding for capital has increased by 28 percent since 1987. This includes a 20.5 percent increase from 1989 to 1990.

Capital Funds Expended by UZA Size

Exhibit 105, Capital Funds Expended by UZA Size, reveals that the smallest UZAs increased capital expenditures by 11.6 percent from 1987 to 1990. This is less than the rate of inflation.

- Mid-size UZAs increased capital expenditures by 2.8 percent over 1987. This was also a nine percent increase over 1990.

Exhibit 105



- Large UZAs increased capital expenditures by 31 percent or 983 million dollars over the 1987 level. This also represents an increase of 22 percent or 746 million dollars over the 1989 level of spending.

Trends in Capital Funding by Source

Exhibit 106, Sources of Capital Funds by UZA Size, shows that Section 9, the largest Federal assistance program, increased by 20 percent since 1987, for an average growth rate of 6.5 percent per year over the four year period.

- The discretionary fund, Section 3, the second largest Federal capital assistance program, declined in both total dollars and its share of the total capital funds in 1988 and 1989. Total 1990 dollars allocated under this program returned to a level approximately one percent higher than the 1987 level.

- State funding for capital needs has increased by 47 percent since 1987. This equates to an average of almost 14 percent per year. The States' share of funding has increased from 12 percent in 1987 to 14 percent in 1990.

- Local funding for capital requirements has increased by 74 percent since 1987. This increase averages more than 20 percent per year. Local governments' share of funding has increased from 20 percent in 1987 to 28 percent in 1990.

Trends in Capital Funding by Source and Size of Urbanized Area

Between 1987 and 1990 total capital funding for U.S. transit systems increased by 28 percent. (Exhibit 106) Federal transit capital funds had declined in 1988 and 1989, then increased sharply in 1990. 1990 Federal funding surpassed 1987 funding levels by a full 11.0 percent. The requirements for capital investment have increased even faster, as shown in the 64 percent increase in State and local

funding over the same period. As a result, the Federal share declined from 67.2 percent to 58.1 percent.

Exhibit 106

Sources of Capital Funds by UZA Size
(millions)
1987-1990

UZA Size	Year	Sources of Capital Funds					Total
		Local	State	Section 3	Section 9	Other Federal	
Under 200,000	1987	$12.5	$10.2	$9.2	$52.9	$2.1	$87.0
	1988	2.6	11.3	10.5	50.5	2.6	87.5
	1989	15.2	12.2	16.2	53.5	1.4	98.5
	1990	19.5	15.3	17.3	44.6	1.3	98.0
200,000 to 1 Million	1987	51.5	22.4	16.7	152.4	29.0	272.0
	1988	53.8	26.3	12.7	161.1	10.8	264.7
	1989	49.5	23.1	29.1	149.1	5.6	256.4
	1990	91.5	21.2	10.2	153.6	2.9	279.5
Over 1 Million	1987	656.1	405.1	821.2	862.1	431.0	3,175.5
	1988	748.0	434.9	811.3	839.0	395.4	3,228.9
	1989	831.3	587.9	671.4	977.3	344.5	3,412.4
	1990	1,143.6	608.1	825.7	1,085.5	495.2	4,158.1
Total Dollars	1987	720.1	438.7	847.1	1,067.9	462.2	3,535.9
	1988	814.4	472.5	834.5	1,050.5	409.2	3,581.1
	1989	896.0	623.2	716.7	1,179.9	351.5	3,767.3
	1990	$1,254.2	$644.6	$853.2	$1,284.0	$499.5	$4,535.5

Note: Slight deviations in totals may occur due to rounding.

The trend of Federal, State and local capital assistance within each UZA size group was similar to the transit industry trend observed during the 1987-1990 period.

Larger UZAs that relied heavily on Section 3 grants experienced substantial declines in Federal assistance in 1988 and 1989, and used more local assistance. Federal capital funding for large UZA programs rebounded in 1990, to a point 12.8 percent higher than 1987.

Total capital funding for mid-sized UZAs increased by 2.6 percent from 1987, to $279 million.

- Medium sized UZAs (between 200,000 and 1 million population) experienced an actual decline in Federal funding, due to a $7.0 billion drop in other DOT funding. However, Section 3 funding increased by 12 percent. Section 9 funding, their primary support, increased 7 percent.

- Mid-sized UZAs increased their shares of State and local assistance for capital from 27 percent to 40 percent to meet increased needs. State dollars declined from $22.4 million to $21.1 million. Local dollars increased by 78 percent, to $91.5 million. Local funds now provide 33 percent of capital assistance for mid-sized UZAs.

Total capital funding for small UZAs increased by 11.6 percent, to 97.1 million dollars. Simultaneously, small UZAs experienced a 1.6 percent decline in Federal funding. Section 9 assistance declined by 16.7 percent. However, some of this de-

cline likely reflects local options of using Section 9 for operating assistance rather than capital assistance, since operating assistance increased for this group during the same period. Section 3 assistance increased by almost 90 percent.

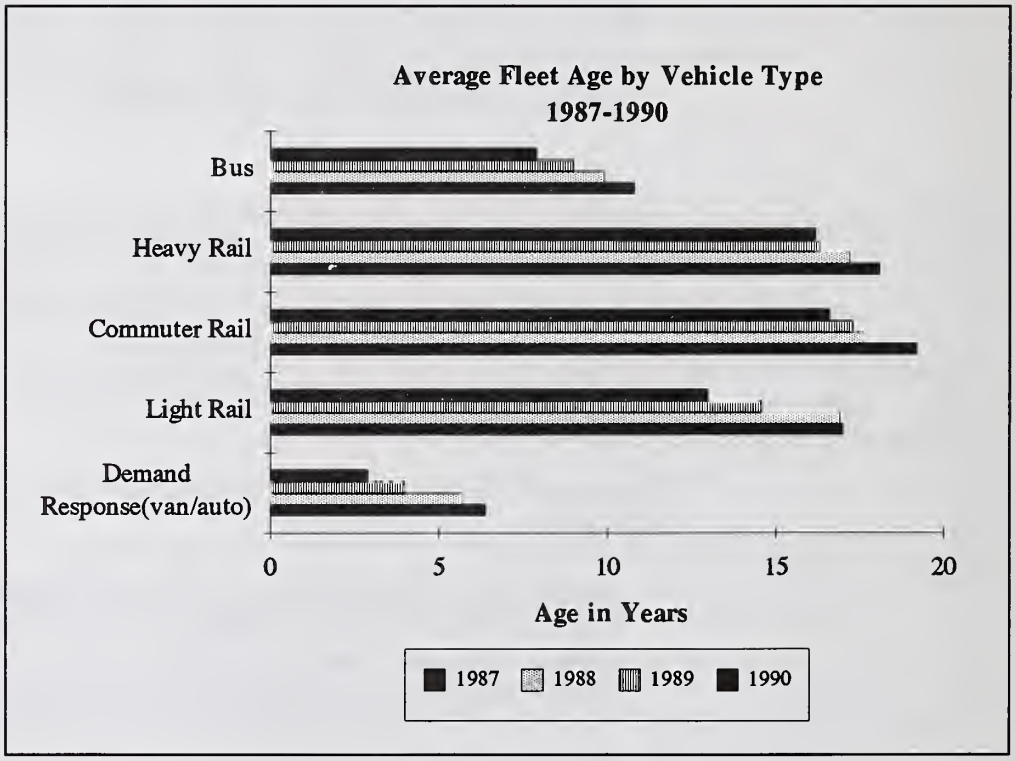
- State funding increased by almost 50 percent over the four years. State funding now represents 16 percent of capital funding for small UZAs. Local funding increased by 48 percent over the same period. The local share of capital funding increased from 14 percent in 1987 to 19 percent in 1990.

Capital Performance Measures by Mode

Average Fleet Age by Vehicle Type

Decreases in average vehicle age suggest one result of the recent heavy investment of capital funds. Exhibit 107, Average Fleet Age, reveals that the average fleet age decreased steadily across almost all vehicle types, indicating active vehicle replacement programs.

Exhibit 107



- Average bus age decreased from 11 years in 1987 to 8 years in 1990. This represents a 27 percent change in only four years.

- Heavy Rail vehicles experienced a major renewal of the fleet in 1988, when the average age dropped from almost 27 years to just over 17 years. The trend continued into 1990, when the average age was 16 years.

- The average age of Commuter Rail vehicles decreased from 19 years to 17 years over the four year period.

- Light Rail vehicles decreased in average age from 17 years to 13 years.

- The mean age of vans and autos, primarily used for Demand Response service, decreased from seven years to three years.

Vehicles by Age and Vehicle Type

Exhibit 108, Vehicles by Age and Vehicle Type, provides additional perspective on the preceding discussion of average fleet age. Each vehicle type enjoys a different useful life, which is greatly influenced by weather, roads, maintenance practices, and local policies on rehabilitation and overhaul. The exhibit shows that there were significant portions of the Bus and rail fleets that needed to be replaced or retired, although there was a decline in the average age.

Exhibit 108

Vehicles by Age and Vehicle Type
1990

Modes	Age in Years						
	5 Years or Less	6 - 11 Years	12 - 15 Years	16 - 20 Years	21 - 25 Years	Over 25 Years	Total
Bus	20,167	22,335	6,733	3,524	1,145	217	54,121
Heavy Rail	749	696	864	1,507	463	827	5,106
CommuterRail	1,585	2,340	1,321	787	1,380	2,912	10,325
Light Rail	374	493	706	3	0	147	1,723
Demand Response*	3,515	470	25	5	0	0	4,015
Total	26,390	26,334	9,649	5,826	2,988	4,103	75,290

*Demand Response in this case only includes van and auto.
Note: Slight deviations in totals may occur due to rounding.

Spare Ratio by Mode (Directly Operated Service)

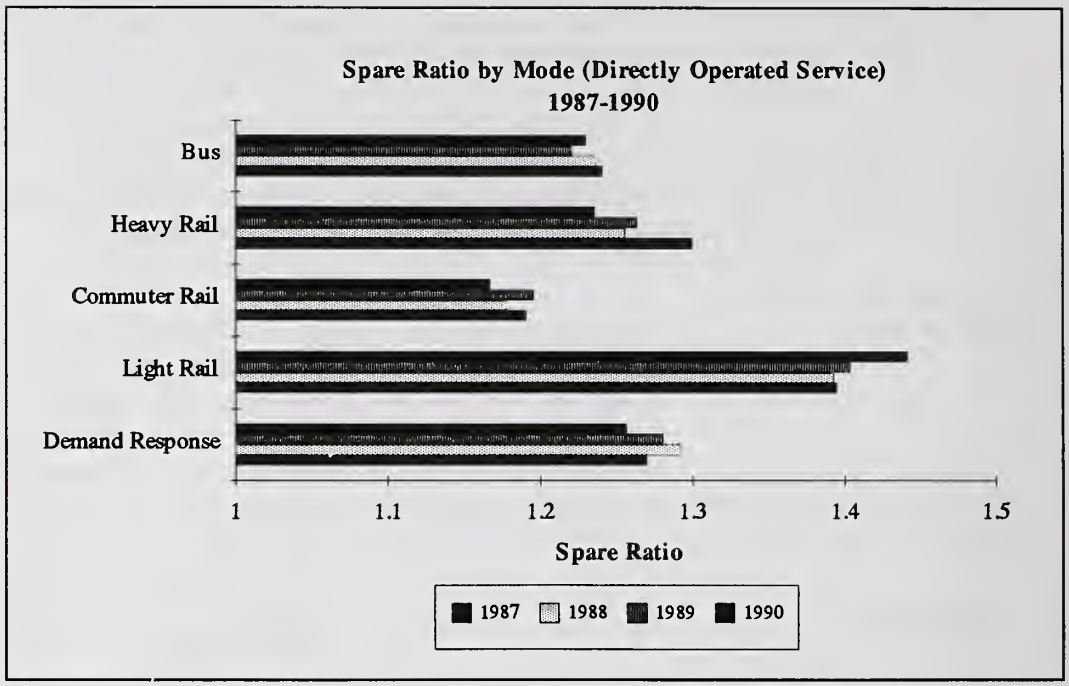
Spare Ratio by Mode (Directly Operated Service), Exhibits 109 and 110, compare the vehicles required for maximum revenue service to the vehicles available for service. Spare ratios may vary based on the timing of capital acquisitions, with dramatic service adjustments, or with intrinsic problems with a certain model in the fleet, requiring removal from service.

- Bus averaged a 23 percent spare ratio for directly operated service. The 1987 level was 24 percent. The spare ratio for Bus varies based on system size. System size ratios are reviewed in the following section.

- Heavy Rail averaged a 24 percent spare ratio. This is a substantial decrease from the 30 percent level of 1987.

- Commuter Rail averaged a 17 percent spare ratio for directly operated service. This is a decrease from the 19 percent level of 1987.

Exhibit 109



- Light Rail averaged a 44 percent spare ratio. This compares to a 40 percent spare ratio in 1989, and a 39 percent ratio in 1988 and 1987.

- Demand Response averaged a 26 percent spare ratio for directly operated service. This is a decrease from the 27 percent level of 1987.

Exhibit 110

Spare Ratio by Mode
(Directly Operated Service)
1987-1990

Modes	Years			
	1987	1988	1989	1990
Bus	1.24	1.24	1.22	1.23
Heavy Rail	1.30	1.26	1.26	1.24
Commuter Rail	1.19	1.18	1.20	1.17
Light Rail	1.39	1.39	1.40	1.44
Demand Response	1.27	1.29	1.28	1.26
Weighted Average	1.25	1.24	1.23	1.23

Note: Slight deviations in totals may occur due to rounding.

Capital Performance Measures by Size of Bus Fleet

Average Fleet Age by Size of Bus Fleet

As noted above, average bus age decreased from almost 11 years to less than eight years. Exhibit 111, Average Fleet Age by Size of Bus Fleet, reveals that the decreases occurred across all sizes of bus fleets at a steady pace. Steady renewal programs of a set percentage of the fleet each year tend to even out and thus reduce

long term expenses. Massive purchases, such as replacing 20 percent of the fleet or more, mean that a significant portion of the fleet experiences critical life-cycle milestones at the same point in time. The steady decrease in fleet age suggests an on-going purchasing program, relying as well on a steady stream of capital funding. FTA generally advises replacement of buses at 12 years; therefore a continued decrease in fleet age may be warranted until stability is reached at an average age of six years.

Exhibit 111

Average Fleet Age
by Size of Bus Fleet
1987-1990

Number of Buses	Years			
	1987	1988	1989	1990
Under 25	10.3	9.9	9.1	8.0
25-99	11.3	10.2	9.0	8.1
100-249	11.3	10.2	8.9	7.7
250 and over	10.8	9.8	9.1	8.0
Weighted Average	10.8	9.9	9.0	7.9

Note: Slight deviations in totals may occur due to rounding.

Vehicles by Age and Size of Bus Fleet

Exhibit 112 shows the number of buses meeting or exceeding Federal standards for replacement based on years in service (generally 12 years).

Exhibit 112

Vehicles by Age and Size of Bus Fleet
(Directly Operated Service)
1990

Number of Buses	Age in Years						
	5 Years or Less	6 - 11 Years	12- 15 Years	16 - 20 Years	21 - 25 Years	Over 25 Years	Total
Under 25	1,117	1,483	410	189	92	24	3,315
25-99	2,527	2,586	1,092	624	126	18	6,973
100-249	4,173	3,551	1,142	727	167	62	9,822
250 and Over	11,134	14,072	3,908	1,956	751	109	31,930
Total	18,951	21,692	6,552	3,496	1,136	213	52,040

Note: Slight deviations in totals may occur due to rounding.

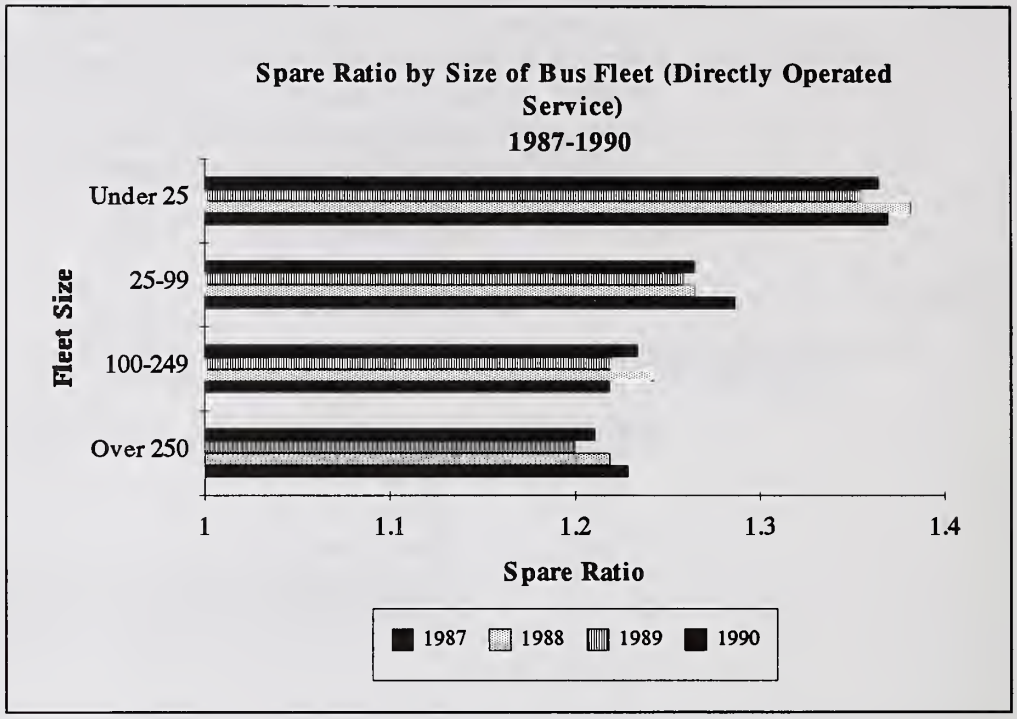
Spare Ratio by Size of Bus Fleet

Exhibits 113 and 114, Spare Ratio by Size of Bus Fleet, show that the spare ratio decreases with increases in the size of the bus system.

- Systems with fewer than 25 vehicles averaged 36 percent spares. This ratio ranged between 35 and 38 percent each year.

- Systems with 25 to 99 buses averaged 27 percent spares. This ratio decreased from its 1987 level of 29 percent.

Exhibit 113



- Systems with 100 to 249 buses averaged 23 percent spares. This ratio fluctuated from 22 percent to 24 percent over the four years.

- Systems with 250 buses or more averaged 21 percent spares. This is a decrease from the 23 percent spare level of 1987. It represents a slight increase from the 20 percent level achieved in 1989.

Exhibit 114

Spare Ratio by Size of Bus Fleet
(Directly Operated Service)
1987-1990

Number of Buses	Years			
	1987	1988	1989	1990
Under 25	1.37	1.38	1.35	1.36
25-99	1.29	1.27	1.26	1.27
100-249	1.22	1.24	1.22	1.23
Over 250	1.23	1.22	1.20	1.21
Weighted Average	1.24	1.24	1.22	1.23

Note Slight deviations in totals may occur due to rounding.

Fixed Guideway Miles by Mode

Fixed guideway is a significant capital expense. Fixed Guideway generally requires land acquisition coupled with a multi-year capital investment. It is comprised of two major categories:

- Pure rail modes, including Heavy Rail, Light Rail, and Commuter Rail; and Other modes, including Bus. (Exhibit 115)

Exhibit 115

Fixed Guideway Miles by Mode
1987-1990

Modes	Years			
	1987	1988	1989	1990
Directional Route Miles				
Heavy Rail	1,315	1,346	1,351	1,351
Commuter Rail	4,940	5,230	4,913	5,094
Light Rail*	464	490	473	483
Total	6,719	7,066	6,737	6,928
Miles of Track				
Heavy Rail	1,701	1,737	1,741	1,744
Commuter Rail	5,729	5,895	5,830	5,964
Light Rail*	501	586	568	687
Total	7,931	8,218	8,139	8,395
Directional Route Miles on Exclusive Right-of-Way				
Bus	477	317	293	383
Trolleybus*	320	343	266	240
Other	106	329	414	470
Total	903	989	973	1,093
Directional Route Miles on Controlled Access Right-of-Way				
Bus	768	553	464	413
Trolleybus*	153	110	120	120
Other	-	-	-	-
Total	921	663	584	533

* Separate identification of fixed guideway has been made in order to maintain standardized reporting.
Note: Slight deviations in totals may occur due to rounding.

- Fixed guideway for the first three rail modes is identified as directional route miles and miles of track. Fixed guideway for the other modes can be identified by directional route miles on exclusive rights of way, and directional route miles on controlled access rights of way.

- Directional route miles for rail modes totaled 6,928 in 1990, which represents an increase of 3.1 percent over 1987 levels. Light Rail experienced the largest percentage increase, of four percent. Commuter Rail, however, claimed almost 74 percent of the rail fixed guideway miles.

- Track miles during the same period increased almost six percent. Light Rail miles of track increased by 37 percent. Heavy Rail track miles increased by 29 percent. Commuter Rail increased by four percent. In 1990, Commuter Rail claimed 71 percent of the track miles.

- Directional route miles (DRM) on exclusive rights of way for Bus and other modes increased by 21 percent since 1987. However, this total increase masks the differences between the modes. Bus DRM fluctuated tremendously. Trolleybus DRM decreased by 25 percent since 1987 (there was a decrease of almost ten percent just since 1989). Other DRM, primarily comprising ferryboat miles, increased significantly. The 1990 level was more than four times the 1987 level, and represents a 13 percent increase over 1989.

Chapter 6

Safety, Reliability and Maintenance Effectiveness

Introduction

The previous four chapters focused on the readily quantifiable measures of service: service consumed, service supplied, operating expense, and operating and capital funding. However, no discussion of transit would be complete without an attempt to measure the quality of service. Since any definition of quality would be subjective at best, the discussion in this final chapter of the *National Transit Summaries and Trends* is limited to data collected through the Section 15 process.

Chapter Organization

The review is divided into two major sections: Safety and Maintenance.

Safety

Safety is evaluated by the number of incidents (accidents) reported and by the number of injuries and deaths associated with transit vehicles and facilities. Incidents, injuries, and personal casualties are first compared to passenger miles and unlinked passenger trips. The number of collision and non-collision incidents is then compared to vehicle miles by mode, size of bus fleet, and size of UZA.

Maintenance

Maintenance efficiency is reviewed through maintenance expense per vehicle revenue mile and vehicle revenue miles per maintenance employee. Reliability is evaluated through miles between road calls by size of urbanized area. Only Bus and Demand Response modes are examined since rail modes are not required to report road call information. Maintenance efficiency and reliability provide the key components of maintenance effectiveness.

Cautions

Cautions on Using Safety Data

One should use caution in using this data to evaluate the safety of using transit. The incidents, injuries and deaths include non-transit patrons. Occupants of a car that strikes a bus, which injures the occupants of the car but not of the bus, would be included in this data set of transit-related injuries. Also, employees or trespassers who are injured in non-public transit facilities are included in the data. Suicides are excluded. Therefore, based on the design and definitions of the report form, the data does not represent the safety of transit patrons. It represents accidents, injuries and deaths associated with transit, and thus overstates the risk to patrons of transit.

Time series data is not used because changes in the Section 15 forms for reporting the data have led to substantial variances in the data from year to year. A revised form was introduced in 1990, which may alleviate and correct these problems. However, there has been widespread debate and concern over the broad definitions and format of the 1990 Safety Form, which may mean that much of the data is questionable.

Cautions on Using Road Call Data

There is much debate within the transit industry over the proper definition and recording of road calls. However, until a better measure is developed, this measure will serve at least as a surrogate for service quality.

Cautions on Using Maintenance Employee Data

The section 15 reporting system collects maintenance data for directly operated service only and only for the reporting agency's employees. Depending on the maintenance practices of an individual Section 15 reporter, there can be a strong reliance on contracting out in order to perform maintenance activities. These contracting out practices are generally associated with overhauls and major component work such as rebuilding transmissions or engines. In addition, a number of reporters, especially those operating as part of a municipal entity, acquire maintenance services on a contractual basis from public works departments. In these situations, maintenance labor is not reported. As noted earlier, there has been continued growth in purchased transportation relationship with an increasing reliance on the purchased transportation provider to perform maintenance. The Section 15 reporting process does not require that the same level of information be provided for directly operated service as for purchased transportation service. Accordingly, one should examine maintenance employee data with the understanding that it is limited to directly operated services. To examine maintenance data more fully, one should evaluate maintenance operating expenses data, since this captures all maintenance data regardless of whether it was performed by employees of directly operated service, was contracted out, or was performed by purchased transportation providers.

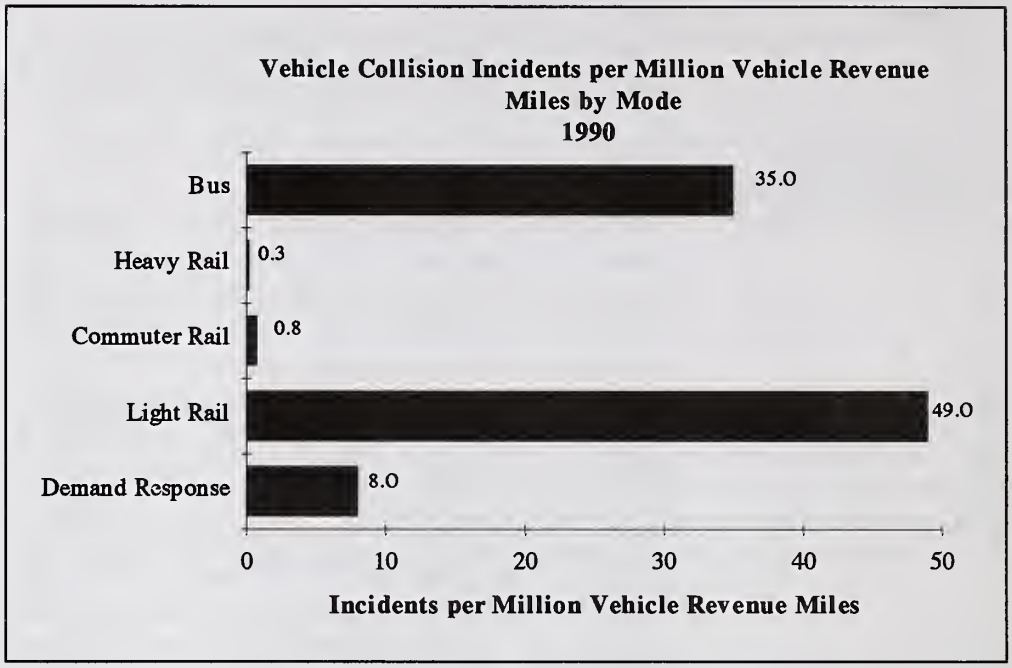
Safety

Vehicle Collision Incidents per Million Vehicle Revenue Miles by Mode

Collisions are defined as any incidents causing injury, death, or $1,000 or more in property damage. Exhibit 116, Vehicle Collision Incidents per Million Vehicle Revenue Miles by Mode, includes collisions with other vehicles, collisions with objects, and collisions with people. Attempted and successful suicides are excluded from this analysis. Safety data is only collected for directly operated service.

- Buses were involved in approximately 35 collision accidents for every million vehicle revenue miles traveled. An explanation for this is that buses are operated in mixed traffic and have frequent stops and starts, which may seem to provoke other vehicles into passing them and thereby create unnecessary risks. Transit operators are sometimes at fault, and many transit agencies place a major emphasis on training and evaluating preventable and non-preventable accidents.

Exhibit 116



- The safety record of Heavy Rail is over 100 times better than that of Bus. Heavy Rail experienced approximately 0.25 accidents for every million vehicle revenue miles operated. Heavy Rail systems operate on exclusive fixed guideway, generally with sophisticated electronics and fail-safe procedures and mechanisms to ensure safety in high-speed operation.

- Commuter Rail experienced about three times the frequency of accidents per mile as did Heavy Rail, achieving about 0.8 accidents per million vehicle revenue miles. Although Commuter Rail operates on fixed guideway, it often shares the track with freight trains and other traffic. It is also exposed to the risk of cross-traffic, such as cars and trucks evading a barrier at a crossing.

- Light Rail experienced about 49 accidents per million vehicle revenue miles, almost 60 percent higher than the Bus accident rate. Light Rail generally shares right of way with regular traffic for significant portions of its service. At those times, Light Rail makes frequent stops, similar to Bus, but does not have the maneuverability to avoid a collision.

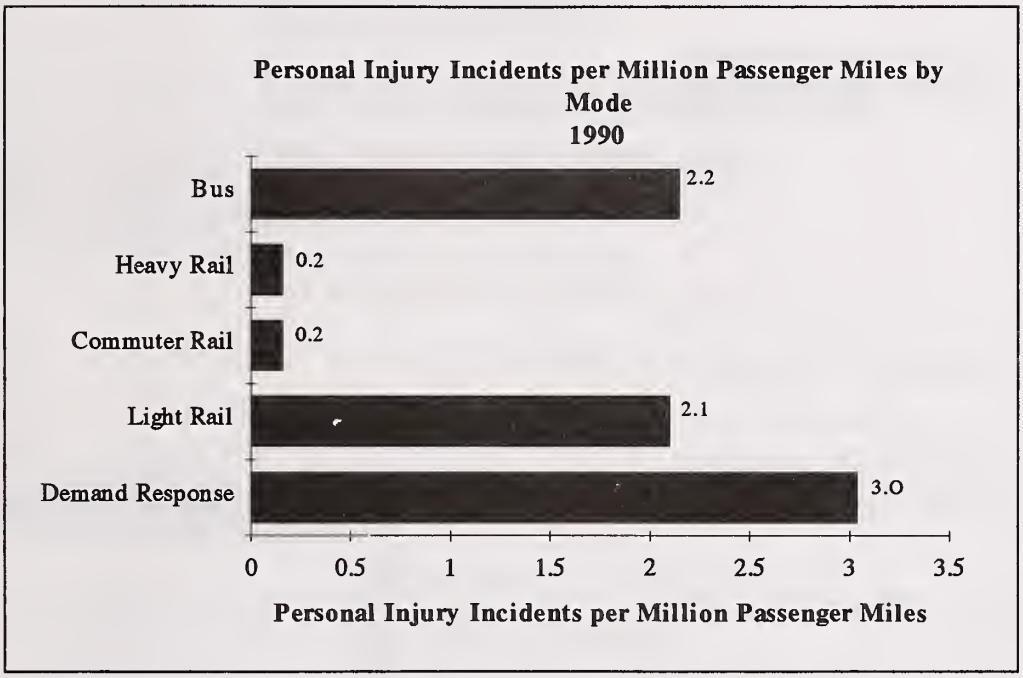
- Demand Response averaged about eight accidents per million vehicle revenue miles. Although Demand Response vehicles operate in mixed traffic, the vehicles are typically small and maneuverable, with infrequent stops that are not as likely to impede traffic.

Personal Injury Incidents per Million Passenger Miles by Mode

Personal Accidents count injuries and deaths associated with transit, not just with transit patrons. Thus, in Exhibit 117, employees, trespassers, and occupants of transit and non-transit vehicles involved in collisions are all considered part of the

injury and death statistics. Injuries and deaths resulting from illness, robberies, assaults and other crimes are not reported. Suicides are specifically excluded from this analysis. Passenger accidents include casualties inside vehicles, in stations and bus stops, and casualties associated with boarding or alighting from a vehicle.

Exhibit 117



Bus averaged 2.2 personal accidents per million passenger miles. As noted above, buses operate in congested conditions and mixed traffic.

- The Bus rate was about 13 times the rate of Heavy Rail, which averaged 0.16 personal accidents for every million passenger miles. Heavy Rail has charge of extensive facilities, such as stations and parking lots, with the associated dangers of escalators, stairs, and walkways.

- Commuter Rail, like Heavy Rail, averaged 0.16 personal accidents per million passenger miles. Commuter Rail stations are generally found at grade, except perhaps in downtown areas. This limits the need and risk of escalators and elevators. The higher rate of collision incidents is offset by fewer station incidents.

- Light Rail averaged 2.1 personal accidents per million passenger miles, the same rate as Bus. Despite the higher rate of collisions for Light Rail noted above, the likelihood of an injury or death is almost identical.

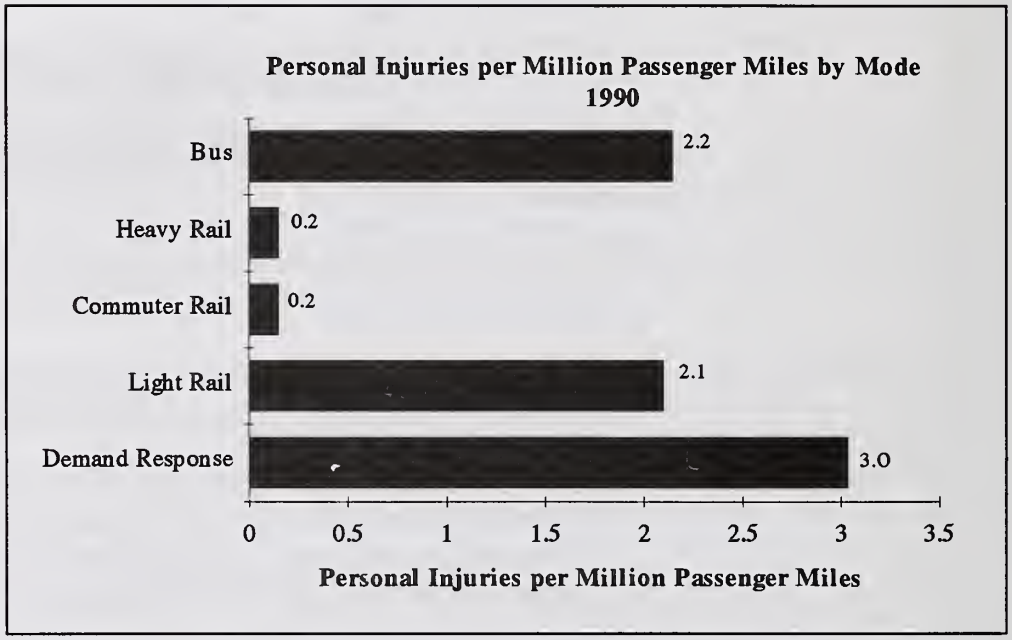
- Demand Response averaged 3.0 personal accidents per million passenger miles. Although Demand Response averaged fewer collision incidents than Bus or Light Rail (per million vehicle revenue miles), it also carried fewer passengers. Demand Response averaged 1.5 passenger miles per vehicle revenue mile (see

Average Load Factor by Mode, Chapter 2). In addition, Demand Response typically serves a high-risk clientele. Demand Response services generally are limited to persons in wheelchairs, persons who are blind, or persons who are mobility impaired. Personal injuries related to boarding and alighting a vehicle, including those associated with lifts, are included in this statistic. This also contributes to the rate of personal accidents per million passenger miles.

Injuries and Deaths per Million Passenger Miles

Exhibit 118, Personal Injuries per Million Passenger Miles by Mode, and Exhibit 119, Deaths per Ten Million Passenger Miles by Mode, subdivide the previous exhibit into Injuries and Deaths. The scale for deaths is ten times that of injuries; yet the rates are still far smaller than injuries. The entire public transit industry reported 44,337 injuries and 244 deaths. About one-half of one percent of personal accidents involved a death.

Exhibit 118

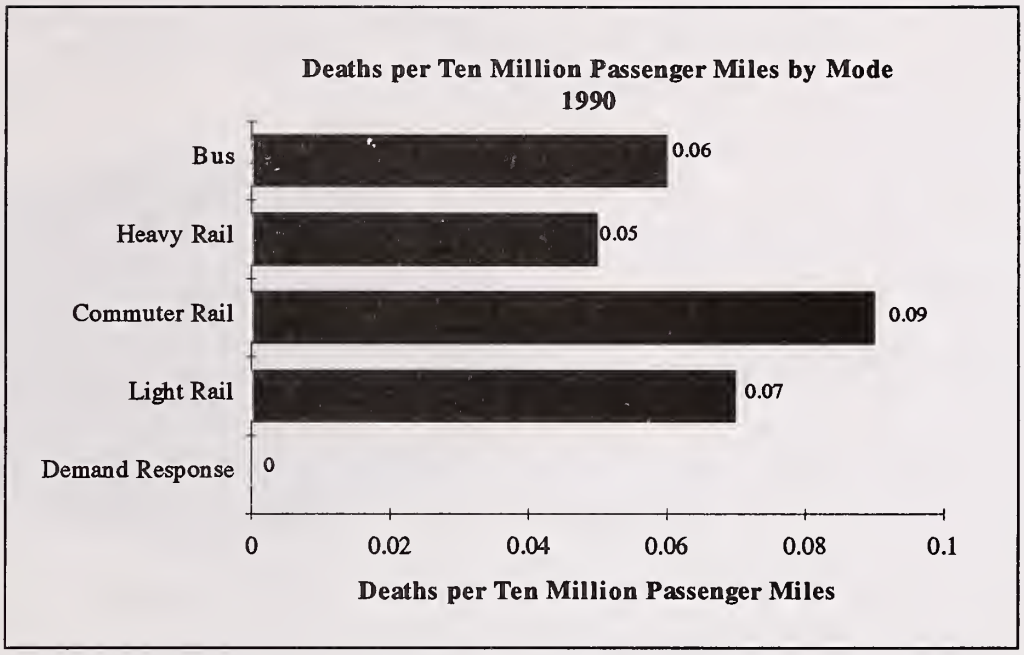


- Bus averaged 2.15 injuries per million passenger miles, and 0.06 deaths per ten million passenger miles. A comparison of deaths to injuries reveals that 0.3 percent of all Bus personal casualties resulted in death.

- Heavy Rail averaged 0.15 injuries per million passenger miles, and 0.05 deaths per ten million passenger miles. Three percent of Heavy Rail personal casualties resulted in death.

- Commuter Rail averaged 0.15 injuries per million passenger miles, and 0.09 deaths per ten million passenger miles. Six percent of Commuter Rail personal casualties resulted in death.

Exhibit 119



- Light Rail averaged 2.10 injuries per million passenger miles, and 0.07 deaths per ten million passenger miles. Three percent of Light Rail personal casualties resulted in death.

- Demand Response averaged 3.04 injuries per million passenger miles. No deaths were reported by Demand Response services.

Comparison of Injuries (Including Death) and Total Unlinked Passenger Trips

Exhibit 120 shows that Bus carried 61 percent of all unlinked passenger trips, but experienced 87 percent of all personal injuries and deaths.

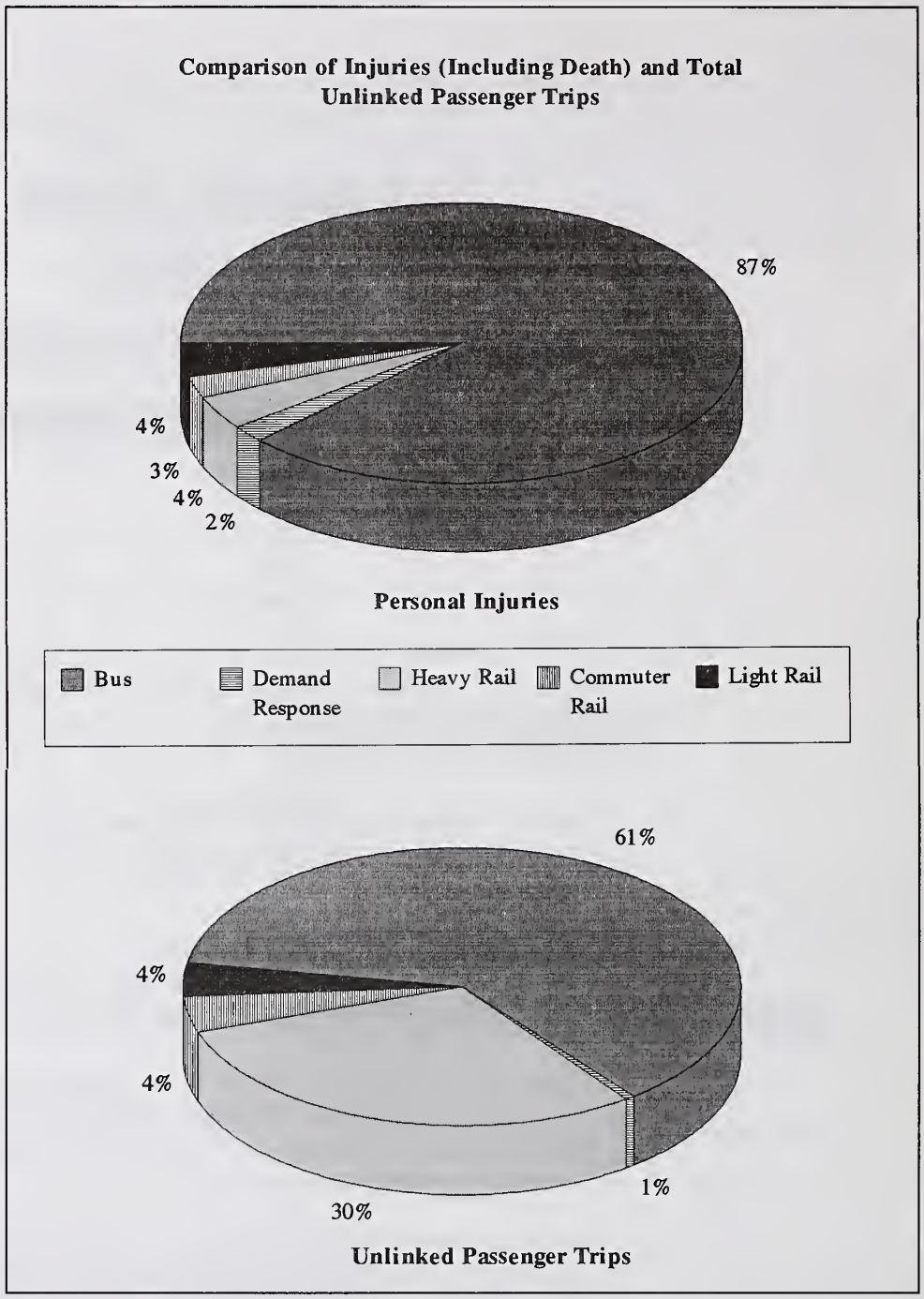
- Heavy Rail carried 29 percent of all unlinked passenger trips, yet experienced four percent of personal casualties. Separated fixed guideway with highly automated signalization and safety measures makes Heavy Rail the safest mode, based on passengers carried.

- Commuter Rail carried four percent of all unlinked passenger trips, and experienced three percent of personal casualties. As noted above, Commuter Rail is virtually identical with heavy rail based on personal injuries per passenger mile. However, since Commuter Rail patrons take much longer trips, Heavy Rail is safer in comparisons with passengers.

- Light Rail carried four percent of all unlinked passenger trips, and experienced four percent of personal casualties.
- Demand Response carried 0.5 percent of all unlinked passenger trips, and experienced 1.8 percent of personal casualties.

- Demand Response carried 0.5 percent of all unlinked passenger trips, and experienced 1.8 percent of personal casualties.

Exhibit 120



Incidents by UZA Size and Type

Transit systems are required to report all incidents resulting in an injury or fatality, and all incidents with property damage over $1,000. Collision incidents include collisions with other vehicles, collisions with objects, and collisions with people. Attempted and successful suicides are subtracted from the above counts for this analysis. Non-collision incidents include derailments, fires, personal casualties inside vehicles, in stations or bus stops, and those related to boarding or alighting from a vehicle.

Exhibit 121

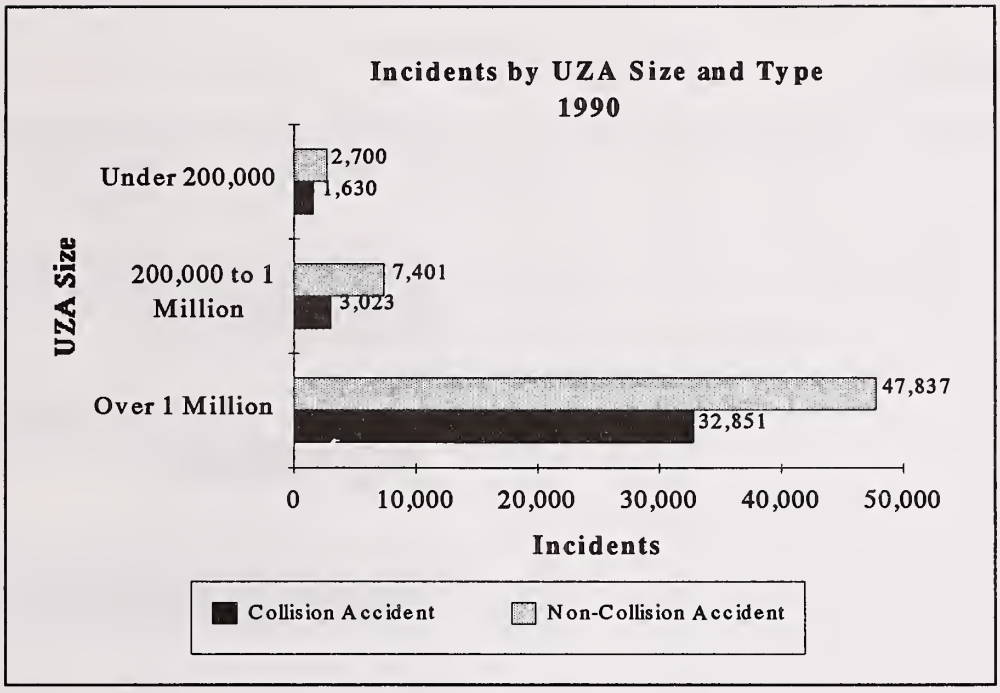


Exhibit 121, Incidents by UZA Size and Type, shows that the largest UZAs experienced the largest number of incidents, as should be expected from the higher service levels supplied. Collision incidents correspond roughly to the number of service miles supplied by size of UZA.

- Large UZAs experienced 83 percent of collision incidents and 88 percent of non-collision incidents. As noted in Chapter 1, large UZAs provided 81 percent of all vehicle revenue miles. The higher proportion of non-collision incidents reflects the additional liability potential in large UZAs due to escalators, stairs, platforms and other associated property that are part of the rail transit infrastructure.

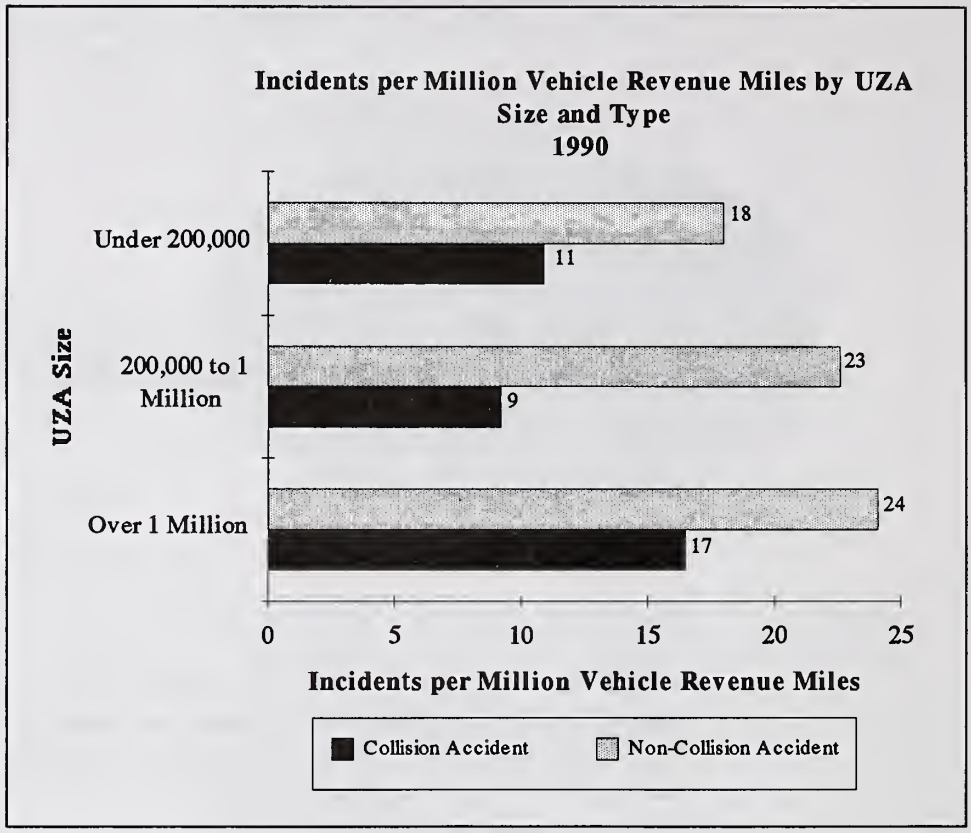
- Medium sized UZAs, between 200,000 and one million population, experienced 13 percent of collision incidents and eight percent of non-collision incidents. Mid-sized UZAs provided 13 percent of all vehicle miles of service.

- Small UZAs experienced five percent of collision incidents and four percent of non-collision incidents. Miles between collision incidents correspond to the six percent of service miles supplied in the small UZAs.

Incidents per Million Vehicle Revenue Miles by UZA Size

Exhibit 122, Incidents per Million Vehicle Revenue Miles by UZA Size and Type, shows that the average number of collision incidents per million miles increased with the increase in size of the urbanized area. This is consistent with the comparisons of incidents and service supplied reported above.

Exhibit 122



- Small UZAs averaged 18 collision incidents for every million miles of service.
- UZAs between 200,000 and one million population averaged 22.6 collision incidents for every million miles of service.
- UZAs with over one million population averaged 24.1 collision incidents for every million miles of service.

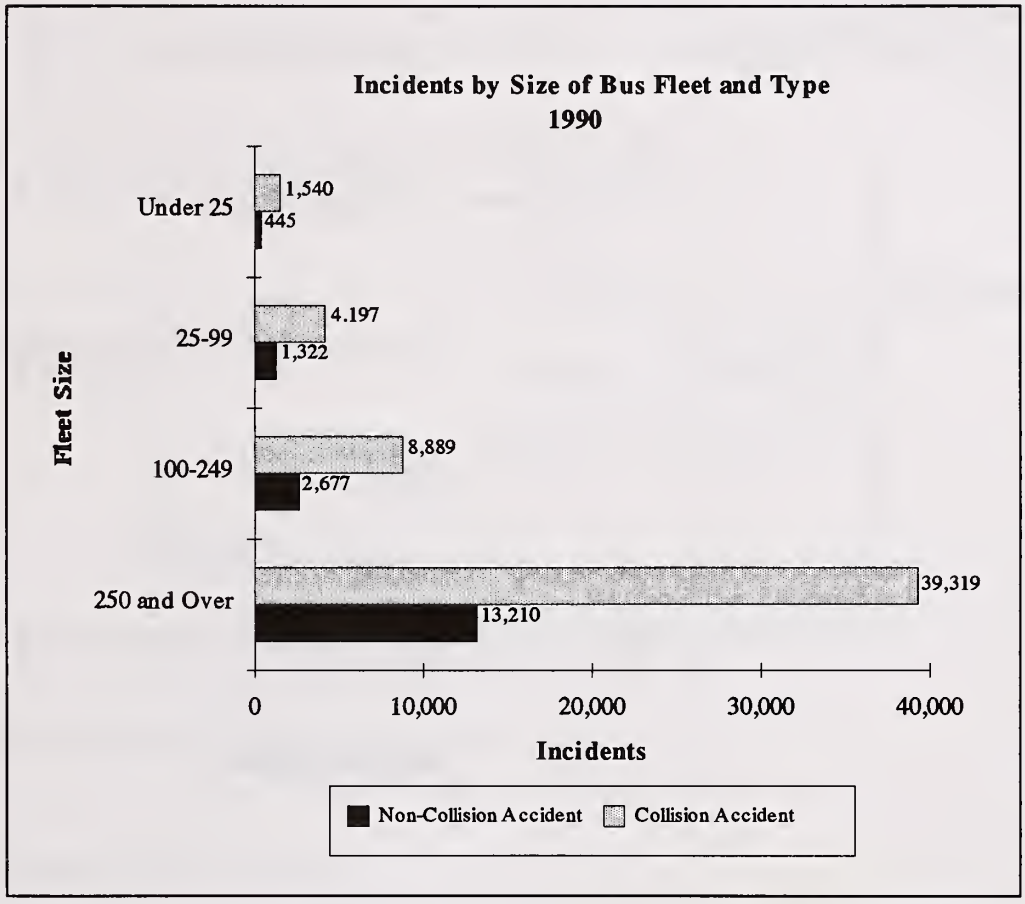
The average of non-collision incidents was lowest for mid-sized urbanized areas.

- Small UZAs averaged 10.9 non-collision incidents for every million miles of service.
- UZAs between 200,000 and one million population averaged 9.2 non-collision incidents for every million miles of service.
- UZAs with over one million population averaged 16.5 non-collision incidents for every million miles of service. Again, the higher rate of non-collision incidents correlates to the extensive facilities controlled by the transit systems in the large UZAs. Subway platforms, escalators, and elevators increase the rail transit agency's exposure to risk. There is also disagreement within the transit industry on whether incidents involving trespassers and employees (especially in non-public areas) should be counted among these statistics. They are included in accordance with 1990 definitions.

Incidents by Size of Bus Fleet and Type

Exhibit 123 shows that collision incidents for buses by size of bus fleet correspond roughly to the total miles of service supplied.

Exhibit 123



- Small bus systems (with fewer than 25 vehicles) reported five percent of the collision incidents and provided seven percent of the service.
- Systems with 25 to 99 buses reported 14 percent of the collision incidents and provided 14 percent of the service.
- Systems with 100 to 249 buses reported 19 percent of the incidents and provided 19 percent of the service.
- Systems with 250 buses or more reported 62 percent of the collision incidents and provided 60 percent of service miles.

Non-collision incidents do not correlate as closely to miles of service.

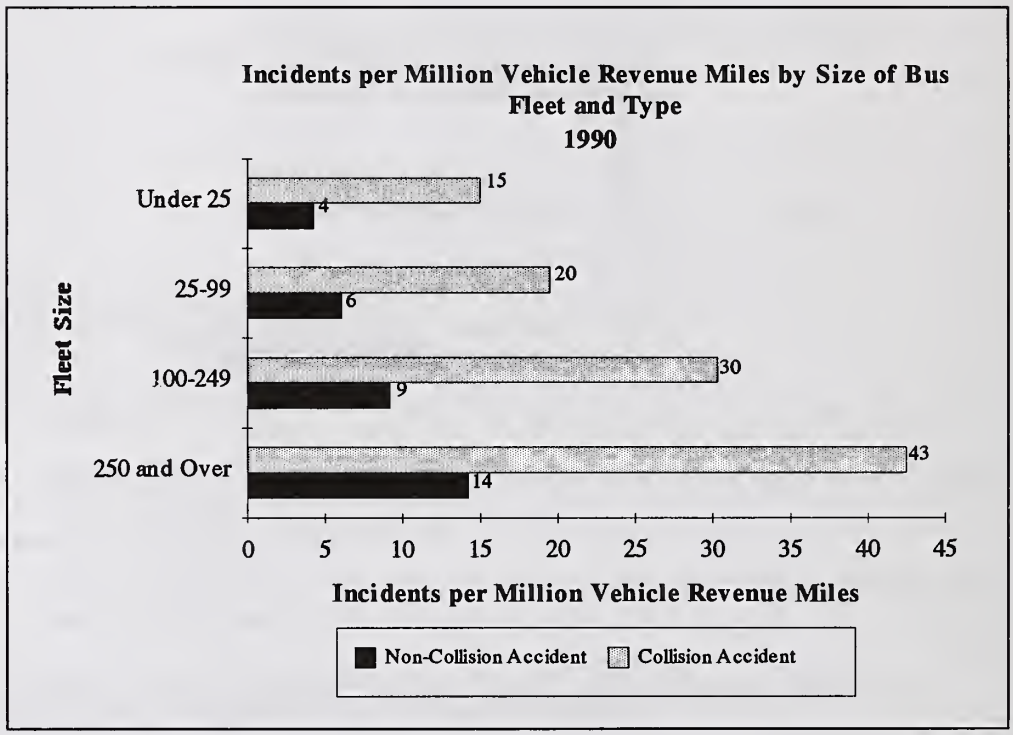
- The smallest systems incurred only three percent of non-collision incidents.

- Systems with 25 to 99 buses reported ten percent of non-collision incidents.
- Systems with 100 to 249 buses incurred 16 percent of non-collision incidents.
- Systems with over 250 buses incurred 71 percent of non-collision incidents.

Incidents per Million Vehicle Revenue Miles by Size of Bus Fleet and Type

Consistent with the percentages reported above, the smallest systems enjoy the best safety records for both collision and non-collision incidents. Exhibit 124 reveals that the rate of incidents increased steadily with the size of bus system.

Exhibit 124



- Systems with fewer than 25 buses averaged 15 collision incidents and 4.3 non-collision incidents for every million miles of service supplies.
- Systems with 25 to 99 buses averaged 19.5 collision incidents and 6.1 non-collision incidents for every million miles of service.
- Systems with 100 to 249 buses averaged 30.3 collision incidents and 9.2 non-collision incidents for every million miles of service.
- Systems with over 250 buses averaged 42.5 collision incidents and 14.3 non-collision incidents for every million miles of service.

Collision and Non-Collision Incidents per Million Vehicle Revenue Miles by Size of Bus Fleet

The two previous exhibits have been combined into tabular form in Exhibit 125, Collision and Non-Collision Incidents per Million Vehicle Revenue Miles by Size of Bus Fleet.

Exhibit 125

Collision and Non-Collision Incidents per Million Vehicle Revenue Miles by Size of Bus Fleet
1990

Number of Buses	Measures				
		Incidents		Incidents per Million Revenue Miles	
	Miles (millions)	Collision	Non-Collision	Collision	Non-Collision
Under 25	102.3	1,531	445	15.0	4.3
25-99	215.3	4,197	1,322	19.5	6.1
100-249	291.1	8,818	2,677	30.3	9.2
250 and over	925.8	39,319	13,210	42.5	14.3
Weighted Average	-	-	-	35.1	11.5
Total	1,534.5	53,865	17,654	-	-

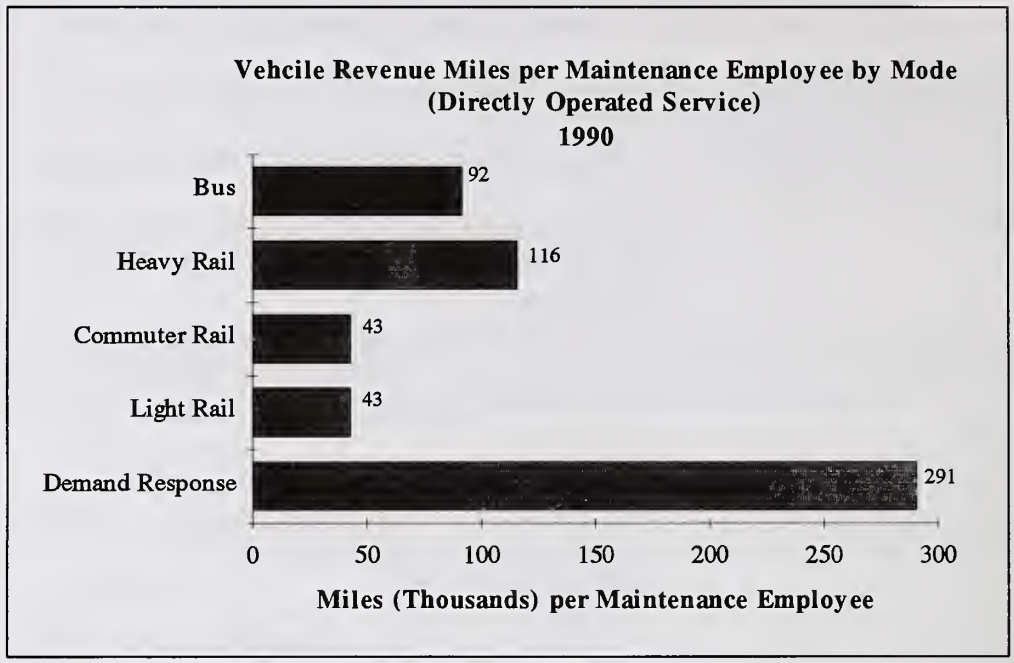
Note: Slight deviations in totals may occur due to rounding.

Maintenance Review: Vehicle Revenue Miles per Maintenance Employee by Mode (Directly Operated Service)

Miles per maintenance employee is an indicator of labor efficiency. Exhibit 126, Vehicle Revenue Miles per Maintenance Employee by Mode (Directly Operated Service), compares diverse modes with diverse requirements, and provides additional perspective on the labor intensity of the various modes.

- Bus systems averaged one maintenance employee for every 92 thousand miles of service.
- Heavy Rail averaged 116 thousand miles of service per maintenance employee.

Exhibit 126



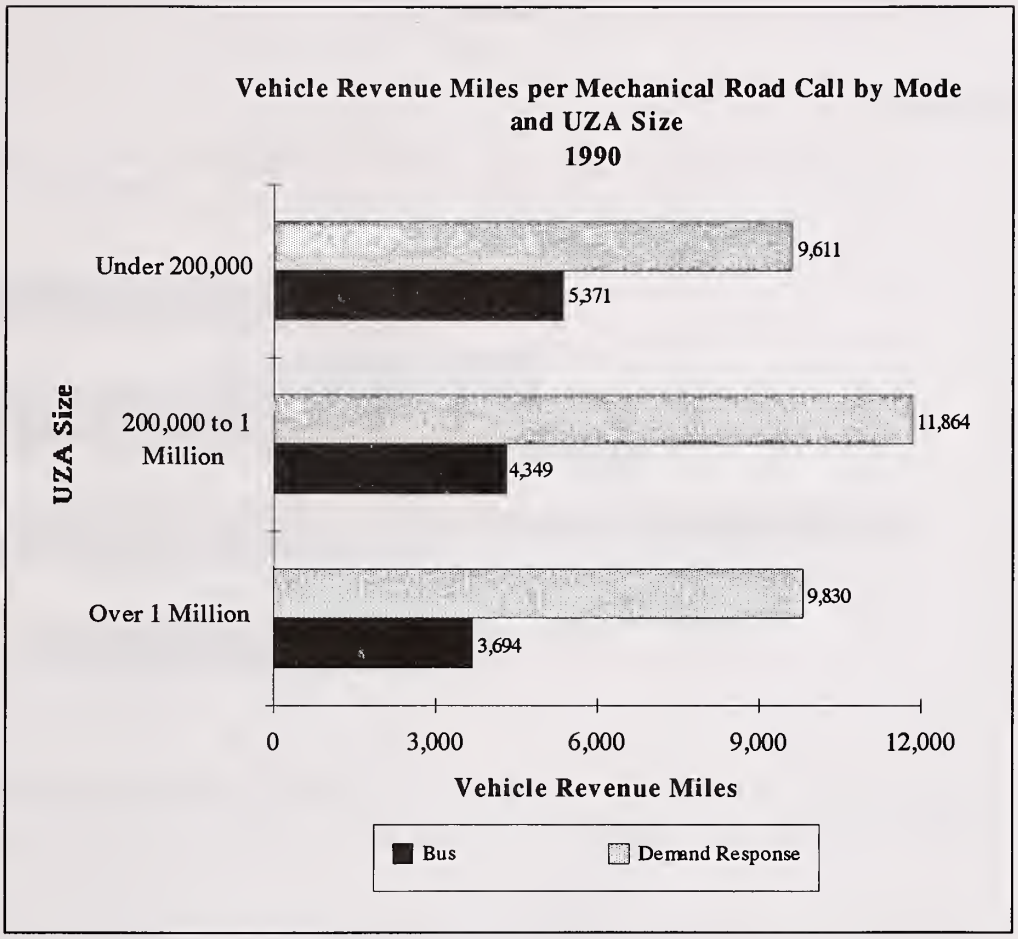
- Commuter Rail required one maintenance employee for every 43 thousand miles of service.
- Light Rail averaged 43 thousand miles of service per maintenance employee.
- Demand Response service, as reported, required only one maintenance employee for 291 thousand miles of service.

Vehicle Revenue Miles per Mechanical Road Call by Mode and UZA Size

As noted above, the transit industry has not yet achieved consistency in defining and reporting road calls. However, Exhibit 127, Vehicle Revenue Miles per Mechanical Road Call by Mode and UZA Size shows that, in aggregate, reporting between small and large urbanized areas for Bus and Demand Response appears to be consistent. Commuter Rail and other Rail modes are not required to report this statistic.

- Average miles between road calls for Bus was 5,376 for UZAs with less than 200,000 population. The Demand Response average is 9,611 miles.
- UZAs with 200,000 to one million population averaged one Bus road call for every 4,326 vehicle revenue miles. The Demand Response average is 11,864 miles.
- UZAs with over one million population averaged 3,694 miles between Bus mode road calls. The Demand Response average is 9,830 miles.

Exhibit 127



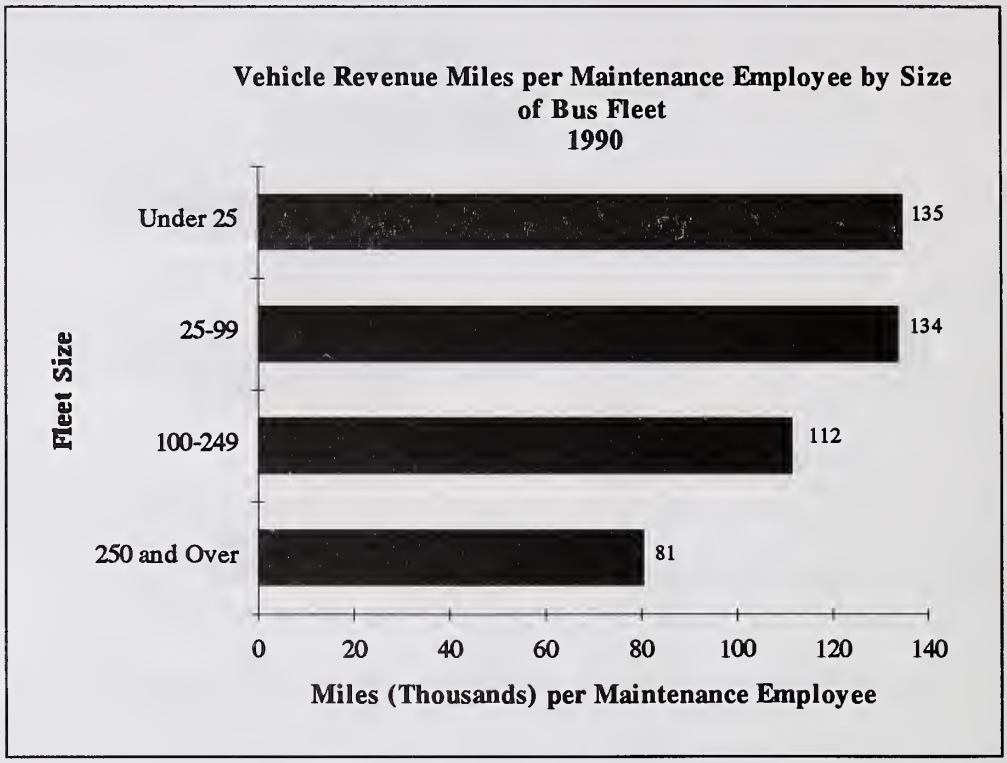
Vehicle Revenue Miles per Maintenance Employee by Size of Bus Fleet

Exhibit 128 shows that the number of maintenance employees required for a given level of bus service increased with the size of the system.

- Systems with fewer than 25 buses appear the most efficient, requiring only one maintenance employee for 135 thousand miles of service.
- Systems between 25 and 100 buses managed almost 134 thousand miles per maintenance employee. Sometimes, small and mid-size systems consolidate with other public entities for maintenance. If maintenance is not performed by system employees, the average for these systems will increase.
- Systems with 100 to 250 buses averaged 112 thousand miles per maintenance employee.

- Systems of over 250 buses averaged 81 thousand miles of service for each maintenance employee.

Exhibit 128



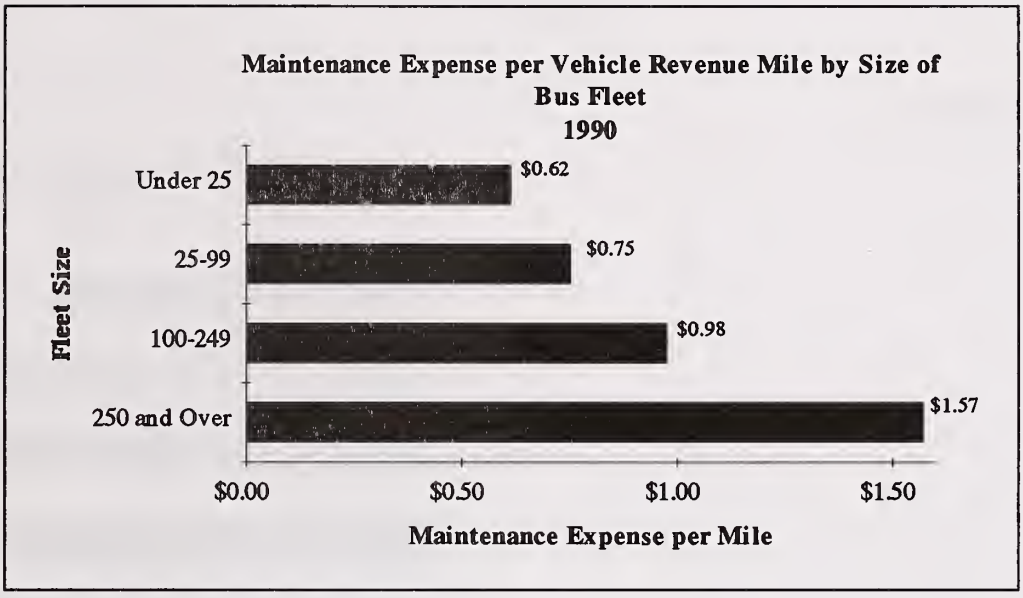
Many factors influence the number of maintenance employees required to maintain equipment. Some systems subcontract all heavy maintenance, such as rebuilds of components; other systems perform this work in-house, up to and including the complete rehabilitation of entire buses. As noted above, some systems subcontract for most or all maintenance functions. The age of the fleet and the technological complexity of the components also affect maintenance requirements. Enhancements such as wheel chair lifts, electronic signs, and electronic fareboxes require system support. Weather and geography also play significant roles in creating wear and tear, thereby influencing maintenance employee requirements.

Maintenance Expense per Vehicle Revenue Mile by Size of Bus Fleet

Consistent with the employee counts above, Exhibit 129 reveals that maintenance expense per vehicle mile increased with the size of the system. In addition, maintenance expense as a portion of total system operating expense increased with the size of the system.

- Systems with fewer than 25 buses appear the most cost efficient, averaging $.62 per mile of service. This represents 15 percent of the average $4.00 per mile in small system operating expense.

Exhibit 129



- Systems with 25 to 100 buses averaged about $.75 per mile of service. This represents 22 percent of this system size's average $3.39 per mile operating expense.

- Systems with 100 to 250 buses averaged $.98 per mile of service. This represents 24 percent of the average $4.03 per mile operating expense for this size of system.

- Systems with over 250 buses averaged $1.57 per mile of service. This represents 26 percent of the average $5.97 per mile operating expense for the largest systems.

Vehicle Revenue Miles per Maintenance Employee by Region

Exhibit 130 shows that comparisons by region represent the distinct blend of modes and densities, ages and sizes of urbanized areas.

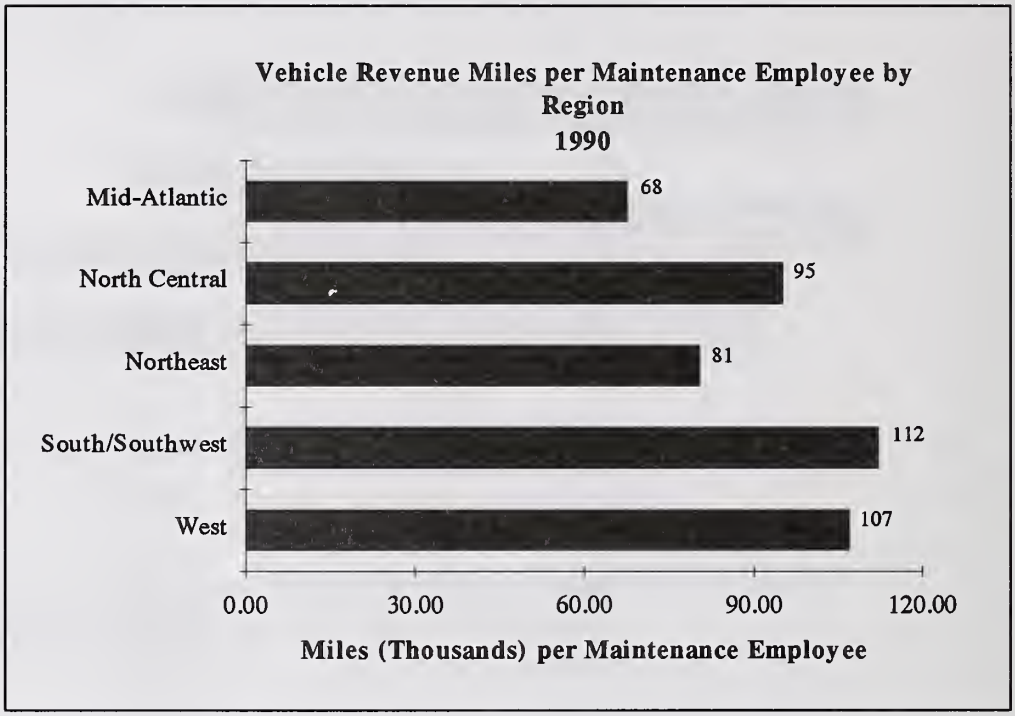
- The Mid-Atlantic averaged the lowest level of miles per maintenance employee, at 67.7 thousand.

- The Northeast averaged 80.5 thousand miles per maintenance employee.

- The North-Central region averaged 95.3 thousand miles per maintenance employee.

- The West averaged 107 thousand miles per maintenance employee.
- The South-Southwest averaged 112.2 thousand miles per maintenance employee.

Exhibit 130



Maintenance requirements by region reflect modes of service, the age and technological complexity of the fleet, and the condition of the infrastructure. It also reflects management choices in contracting for services or rebuilding components and performing major repairs in-house.

The above comparisons are not intended to support one pattern of choices over another, but merely to suggest an array of choices by region.

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